Marconi
Instruments

AM/FM SIGNAL GENERATORS

2030 SERIES

Service Manual

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SIGNAL GENERATORS

2030 series

2030 10 kHz to 1.35 GHz
2031 10 kHz to 2.7 GHz
2032 10 kHz to 5.4 GHz

Includes information on:
Option 001 - Second LF oscillator
Option 002 - Pulse modulation
Option 003 - +19 dBm RF output level
Option 005 - GMSK Bt 0.3
Option 006 - Avionics
Option 007 - Digital and vector
Option 008 - RF profiles and complex sweep
Option 100 - Single fuse version
Option 105 - Modified pulse

This manual applies to instruments with software issues of 5.001 and higher.

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PREFACE

WARNINGS, CAUTIONS and NOTES

These terms have specific meanings in this manual:-

WARNINGS contain information to prevent personal injury.
CAUTIONS contain information to prevent damage to the equipment.
Notes contain important general information.

HAZARD SYMBOLS

The meaning of hazard symbols appearing on the equipment is as follows:

Symbol	Nature of hazard	Reference in manual
	Dangerous voltage	Page iv
	Beryllium	Page v
	Fire hazard	Page iv
	Lithium batteries are used in this equipment. Appropriate caution should be exercised when handling these items.	Page v

SAFETY

This product has been designed and tested in accordance with BS4743 'Specification for safety requirements for electronic measuring apparatus' and IEC Publication 348 'Safety requirements for electronic measuring apparatus'.

MANUAL AMENDMENT STATUS

Each page in this manual bears the date of its original issue or, if it has been amended, the date of the amendment. Any changes subsequent to the latest amendment are included on Manual Change sheets coded C1, C2 etc. at the front of the manual.

OPERATING PRECAUTIONS

WARNING - ELECTRICAL HAZARDS

AC supply voltage. This equipment conforms with IEC Safety Class 1, meaning that it is provided with a protective grounding lead. To maintain this protection the supply lead must always be connected to the source of supply via a socket with a grounded contact.

Be aware that the supply filter contains capacitors that may remain charged after the equipment is disconnected from the supply. Although the stored energy is within the approved safety requirements, a slight shock may be felt if the plug pins are touched immediately after removal.

Fuses. Note that there are supply fuses in both the live and neutral wires of the supply lead. If only one of these fuses should rupture, certain parts of the equipment could remain at supply potential.

For Option 100, single fuse version only:

Fuses. Note that the internal supply fuse is in series with the live (brown) conductor of the supply lead. If connection is made to a 2-pin unpolarized supply socket, it is possible for the fuse to become transposed to the neutral conductor, in which case, parts of the equipment could remain at supply potential even after the fuse has ruptured.

Removal of covers. Disconnect the supply before removing the covers so as to avoid the risk of exposing high voltage parts. If any internal adjustment or servicing has to be carried out with the supply on, it must only be performed by a skilled person who is aware of the hazard involved.

WARNING - FIRE HAZARD

Make sure that only fuses of the correct rating and type are used for replacement.

If an integrally fused plug is used on the supply lead, ensure that the fuse rating is commensurate with the with current requirements of this equipment. See under 'Performance Data' in Chapter 1 for power requirements.

CAUTION - PULSE INPUT

Before switching the instrument on, ensure that no signal voltage is present on the PULSE INPUT socket.

WARNING - OTHER HAZARDS

Some of the components used in this equipment may include resins and other materials which give off toxic fumes if incinerated. Take appropriate precautions, therefore, in the disposal of these items.

Beryllia (beryllium oxide) is used in the construction of some of the components in this equipment.

This material, if incorrectly handled, could cause a danger to health - refer to the Maintenance part of the Service Manual for safe handling precautions.

A **Lithium** battery is used in this equipment.

Lithium is a toxic substance. Therefore these items should in no circumstances be crushed, incinerated or disposed of in normal waste.

CAUTION - STATIC SENSITIVE COMPONENTS

This equipment contains static sensitive components which may be damaged by handling - refer to the service manual for handling precautions.

CAUTION - TILT FACILITY

When the instrument is in the tilt position, it is inadvisable for stability reasons, to stack other instruments on top of it.

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Chapter 1
GENERAL INFORMATION

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Fig. 1-2 Typical phase noise performance of 2030 Series 1-6

INTRODUCTION

The 2030 series Signal Generators cover the frequency ranges 10 kHz to 5.4 GHz with three models: 2030 (10 kHz to 1.35 GHz), 2031 (10 kHz to 2.7 GHz) and 2032 (10 kHz to 5.4 GHz). A dot matrix display with soft key selected screen options allow flexibility of operation and ease of use. The output may be amplitude, phase, or frequency modulated with pulse modulation available as an option. Modulation is available using a combination of up to two external signal inputs and a built-in LF source (a second internal source is optional).

Microprocessor control ensures that the instruments are flexible and easy to use and allows programming by the General Purpose Interface Bus (GPIB). The GPIB is designed to IEEE Standard 488.2 and is a means of sending commands to an instrument, via a data bus, from a remote controller or personal computer. The instruments can therefore be used manually or as part of a fully automated test system.

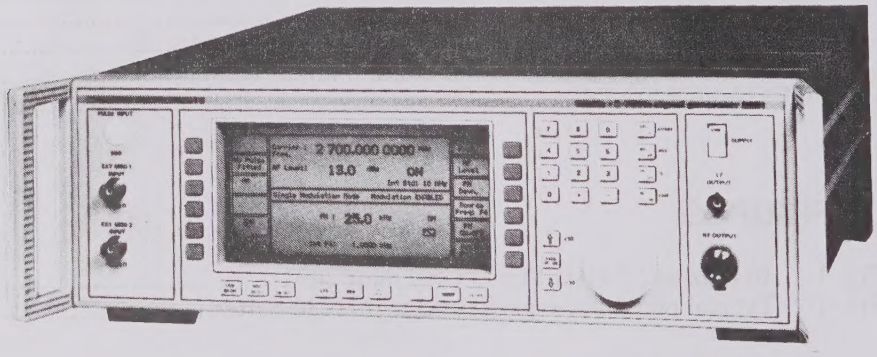

Fig. 1-1 10 kHz to 2.7 GHz Signal Generator 2031

MAIN FEATURES

Operation

Selection of parameters on the screen may involve one or more of the numeric, hard or soft keys or the rotary knob. Hard keys have single or dual functions which remain constant throughout, whereas soft keys have functions dependent on the present mode of operation. Parameters may be set to specific values by numeric key entry, while values may be varied in steps of any size using the ⇑/⇓keys or altered by moving the knob, set to a particular sensitivity.

The SIG GEN, LF, SWEEP, MEM (memory), Δ (delta) and UTIL (utility) menus are selectable, at any point of operation, via the keys below the display panel. Within the display, the soft key functions are indicated by labels which appear alongside the keys situated at either side of the display panel.

Display

The display is a dot matrix liquid crystal panel, with backlighting. Carrier frequency, modulation and RF level are shown in horizontal regions on the principal screen. The display features 11-digit resolution for carrier frequency, 4-digit for RF level and 3-digit for modulation, with unit annunciators.

Contrast may be varied, using the control knob, to optimize the viewing angle. Differing lighting conditions may be accommodated using the backlight intensity function, variable from no backlight to full intensity. A full graphical display test is available, refer to the Service Manual.

Frequency selection

Carrier frequency is selected via the soft key option on the SIG GEN display and direct entry via the keyboard. Alternatively, selection may be made via the General Purpose Interface Bus (GPIB). Frequency resolution is 0.1 Hz across the band. Carrier frequencies can be stored in a non-volatile memory with complete recall when required. An ON-OFF key is provided to completely disable the output.

Output

RF output up to +13 dBm can be set by direct keyboard entry with a resolution of 0.1 dB or better over the entire range. A high output option is available to extend the maximum calibrated level to +19 dBm on the 2030 instrument.

An extended hysteresis facility allows for extended electronic control of RF output level without introducing mechanical attenuator transients when testing squelch systems.

A low intermodulation mode can be selected which disables the RF levelling system and improves the intermodulation performance when combining the outputs of two signal generators.

A choice of calibration units is available to the operator and provision is made for the simple conversion of units (for example, dBm to μV). Calibration data for the output level is held in memory and may be altered from the front panel or over the interface bus.

The output level can be offset by up to ±2 dB by keyboard entry. Offsets from the calibrated value may be used to compensate for cable or switching losses external to the generator. This facility can be used as a means of deliberately offsetting the output level to ensure that all generators in an area give identical measurements. While using the offsetting facility, the principal calibration of the generator is not lost and may be returned to at any time.

An electronic trip protects the generator output against reverse power of up to 50 W, preventing damage to output circuits when RF or DC power is accidently applied.

Modulation

Comprehensive amplitude, frequency (plus wide bandwidth FM), phase and optional pulse modulation are provided for testing a wide range of receivers. An internal modulation oscillator is provided, having a frequency range of 0.1 Hz to 500 kHz, with a resolution of 0.1 Hz. A second modulation oscillator can be included as an option. Two independent BNC inputs on the front panel allow external modulation signals to be mixed with the internal signal(s). Therefore, a maximum of four modulation sources may be available at one time. These sources may be combined to give the single, dual, composite and dual composite modes, see 'MODULATION MODES', Chap. 3-1.

The signalling facility allows testing of radio equipment with sequential and sub-audible tone capability. The sequential calling tone system is accessible from the utility menu for all four modulation modes. Sub-audible calling tones are specified within the modulation source select display.

Incrementing

All major parameters can be incremented or decremented in step sizes entered via keyboard entry or the GPIB. If no step size is entered for a parameter, the steps are preset to 1 kHz for carrier frequency, 1 kHz for modulation oscillator and LF frequency, 1 kHz for FM deviation, 1% for AM depth and 1 dB for output level.

In addition the rotary control can be used to vary the parameter with the sensitivity of the knob being changed by means of the ×10 and ÷10 keys.

Sweep

The sweep capability of the 2030 Series allows comprehensive testing of systems. Four parameters are used to specify sweep; start, stop, number of steps and time per step. These are specified by the user, with upper and lower limits for the parameter values being dependent on the function. The sweep markers menu is available by soft key selection on the sweep display, allowing the placement of up to five user defined markers.

Non-volatile memory

The non-volatile memory allows 50 complete instrument settings, 50 partial settings, 100 carrier frequency settings, 20 sweep settings and 20 signalling tone sequences to be stored for later use at any time.

Programming

A GPIB interface is fitted so that all functions are controllable via the interface bus which is designed to the IEEE Standard 488.2. The instrument can function both as a talker and a listener.

Protection

To prevent accidental interference with the contents of internal memories, internal data is protected by a secure key sequence.

Two levels of protection are offered, appropriate to the function being accessed. The most secure is reserved for features which alter the calibration data of the instrument. The first level of protection is less severe, enabling the user to access functions which are relevant to normal operation, such as selecting the RF level calibration units, RF level offsets and external standard frequency.

Spectral purity

With an SSB phase noise performance at of typically -122 dBc/Hz at 470 MHz (20 kHz offset), the 2030 Series can be used for both in-channel and adjacent channel receiver measurements. Harmonically related signals and non-harmonics are better than -30 dBc and -70 dBc respectively.

Calibration

The 2030 Series has a two year calibration interval and is calibrated entirely by electronically controlled adjustment. There are no internal mechanically adjustable components to affect the calibration. The calibration display is available via soft key selection at the utilities menu.

Options

The following factory-fitted options are available:

Option 001 - Second modulation oscillator

An additional modulation oscillator is available to enable greater flexibility. This second oscillator has the same specification as the first and allows full use of complex modulation modes.

Option 002 - Pulse modulation

The pulse modulation facility allows radar RF and IF stages to be tested and features rise and fall times of less than 15 ns with an on/off ration of better than 70 dB.

Option 003 - High output power

This option extends the output level to +19 dBm on the 2030 model.

Option 005 - GMSK Bt 0.3

Provides GMSK Bt 0.3 modulation at a clock rate of 270.833 kHz in accordance with the GSM and DCS 1800 specifications. The option includes a comprehensive internal data generator.

Option 006 - Avionics

Provides internally generated modulation waveforms suitable for the testing of Instrument Landing systems (ILS) and VHF Omni Range (VOR) beacons.

Option 007 - Digital and vector modulation

In digital mode the generator converts data and clock signals into QPSK or QAM modulation formats with programmable channel filters and data rates. In vector mode I and Q inputs allow the user to generate complex modulation signals with an analogue bandwidth of 10 MHz.

Option 008 - RF profiles and complex sweep

The RF profile facility provides compensation for frequency dependent level errors introduced by cables, amplifiers and signal combiners. The complex sweep facility generates sweeps whose step size, step time and RF level change while the sweep is in progress. These features are particularly useful for EMC, Tempest and ATE applications.

Option 100 - Single fuse

A single fuse is used in place of the standard double fuse.

Option 105 - Modified pulse modulation

Modifies the pulse modulator (Option 002) to provide a slower rise and fall time for testing time domain duplex and time domain multiple access receivers.

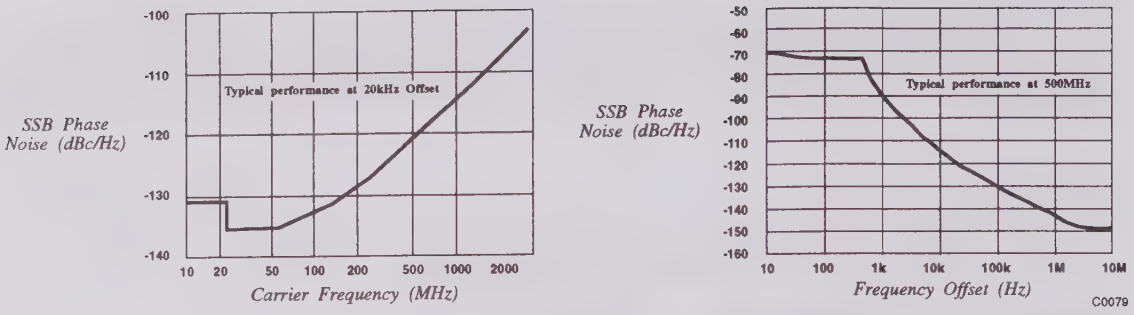

Fig. 1-2 Typical phase noise performance of 2030 Series

PERFORMANCE DATA

CARRIER FREQUENCY

Range	10 kHz to 1.35 GHz (2030); 10 kHz to 2.7 GHz (2031); 10 kHz to 5.4 GHz (2032).
Selection	By keyboard entry of data. Variation by ⇑/⇓ keys and by rotary control.
Indication	11 digits with annunciators.
Resolution	0.1 Hz.
Accuracy	As frequency standard.
Phase incrementing	The carrier phase can be advanced or retarded in steps of π/128 rads (approximately 1.4°) using the rotary control.

RF OUTPUT

Range

-138 dBm to +13 dBm (2030);
-138 dBm to +19 dBm (2030 with Option 003);
-144 dBm to +13 dBm (2031).
-144 dBm to +13 dBm (2032), derated over 4 GHz by 0.1 dB/°C above 40°C.

When AM is selected the maximum output level reduces linearly with AM depth to +7 dBm (+13 dBm for 2030 with Option 003) at maximum AM depth.

Selectable overrange mode allows uncalibrated output levels to +19 dBm to be generated.
Selectable extended hysterisis provides for uncalibrated level control over an 24 dB range without the mechanical attenuator operating.

Selection

By keyboard entry of data. Variation by ⇑/⇓keys and by rotary control. Units may be μV, mV, V EMF or PD; dB relative to 1 μV, 1 mV EMF or PD; dBm. Conversion between dB and voltage units may be achieved by pressing the appropriate units key (dB, or V, mV, μV).

Indication

4 digits with unit annunciators.

Resolution

0.1 dB.

Accuracy

	<1.35 GHz	1.35-2.7 GHz	2.7-5.4 GHz
Above 0 dBm:	±0.65 dB*	±1 dB	±1.5 dB
Above -50 dBm:	±1 dB*	±2 dB	±2 dB
Above -100 dBm:	±1 dB*	±2 dB	±3 dB
Above -127 dBm:	±1 dB*	±2 dB	-

*2030 with Option 003: ±1.2 dB for output levels greater than -127 dBm.

VSWR

For output levels less than 0 dBm:
Less than 1.25:1 to 2.2 GHz (return loss greater than 19.1 dB);
Less than 1.4:1 to 2.7 GHz (return loss greater than 15.6 dB);
Less than 1.5: 1 to 5.4 GHz (return loss greater than 14 dB).

Output protection	An electronic trip protects the generator output against reverse power of up to 50 W from a source VSWR of up to 5:1.
Output connector	50 Ω nominal, N-type female socket.

SPECTRAL PURITY

At RF levels up to +7 dBm :-

Harmonics	2030, 2031: Better than -30 dBc for carrier frequencies to 1 GHz; Better than -27 dBc for carrier frequencies to 2.7 GHz. Better than -27 dBc for carrier frequencies to 1.35 GHz; (2030 with Option 003). 2032: Better than -25 dBc for carrier frequencies to 5.4 GHz.
Sub-harmonics	Better than -90 dBc to 1.35 GHz. Better than -40 dBc to 2.3 GHz. Better than -30 dBc to 5.4 GHz.
Non-harmonics	Better than -70 dBc to 5.4 GHz for offsets from the carrier frequency of 3 kHz or greater.
Residual FM (FM off)	Less than 7 Hz RMS deviation in a 300 Hz to 3.4 kHz unweighted bandwidth at 470 MHz.
SSB phase noise	Less than -116 dBc/Hz (typically -122 dBc/Hz) at an offset of 20 kHz from a carrier frequency of 470 MHz.
RF leakage	Less than 0.5 µV PD generated at the carrier frequency across a 50 Ω load by a two turn 25 mm loop, 25 mm or more from the case of the generator with the output terminated in a 50 Ω sealed load.
FM on AM	Typically less than 100 Hz for 30% AM depth at a modulation frequency of 1 kHz and a carrier frequency of 500 MHz.
ΦM on AM	Typically less than 0.1 radian at a carrier frequency of 500 MHz for 30% AM depth for modulation rates up to 10 kHz.

MODULATION MODES

Four modulation modes are available:

Single	FM, Wideband FM, ΦM, AM or pulse (optional).
Dual	Two independent channels of differing modulation type (e.g. AM with FM).
Composite	Two independent channels of the same modulation type. (e.g. FM1 with FM2).
Dual composite	A combination of Dual and Composite modes providing four independent channels (e.g. AM1 with AM2 and FM1 with FM2).

FREQUENCY MODULATION

Deviation	Peak deviation from 0 to 1 MHz for carrier frequencies up to 21.09375 MHz; Peak deviation from 0 to 1% of carrier frequency above 21.09375 MHz.
Selection	By keyboard entry of data. Variation by ⇑/⇓ keys and by rotary control.
Indication	3 digits with annunciators.
Displayed resolution	1 Hz or 1 least significant digit, whichever is greater.
Accuracy at 1 kHz, internal modulation	±5% of indication ±10 Hz excluding residual FM.
Accuracy at 1 kHz external modulation	±5% of indication ±10 Hz excluding residual FM. With ALC off, the modulation is calibrated for an input level of 1.0 V PD RMS sine wave.
Bandwidth (1 dB)	DC to 300 kHz (DC coupled). 10 Hz to 300 kHz (AC coupled). Typical 3 dBm bandwidth exceeds 1.2 MHz. Capable of accepting external sources of FSK signals.
Carrier frequency offset	In DC FM mode less than ±(1 Hz + 0.1% of set deviation) after using DC FM nulling facility.
Distortion	Using external modulation without ALC: Less than 3% at maximum deviation for modulation frequencies up to 20 kHz; Less than 0.3% at 10% of maximum deviation for modulation frequencies up to 20 kHz.
Modulation source	Internal LF generator or external via front panel sockets.

WIDEBAND FM

Deviation	A rear panel input on a BNC connector allows an external modulation signal to produce up to the maximum deviation. The deviation is controlled in 3 dB steps only and the generator will display the deviation equivalent to 1 V RMS sine wave input.
Indication	3 digits with annunciators.
Selection	By keyboard entry of data. The sensitivity is controlled in 3 dB steps and the display will indicate the value of deviation nearest to the requested value.
Input level	1 V RMS sine wave to achieve indicated deviation.
Accuracy	As FM.
3 dB bandwidth	Typically 10 MHz (DC or AC coupled).
Modulation source	External via rear panel socket (50 Ω impedance).

PHASE MODULATION

Deviation	0 to 10 radians in 0.01 radian steps.
Selection	By keyboard entry of data. Variation by ⇑/⇓ keys and by rotary control.
Indication	3 digits with annunciators.
Accuracy at 1 kHz	Better than ±5% of indicated deviation excluding residual phase modulation.
3 dB bandwidth	100 Hz to 10 kHz.
Distortion	Less than 3% at maximum deviation at 1 kHz modulation rate.
Modulation source	Internal LF generator or external via front panel sockets.

AMPLITUDE MODULATION

For carrier frequencies up to 1 GHz (and for output levels less than +13 dBm with Option 003):

Range	0 to 99.9% in 0.1% steps.
Selection	By keyboard entry of data. Variation by ⇑/⇓ keys and by rotary control.
Indication	3 digits with annunciator.
Depth accuracy at 1 kHz	±4% of setting ±1%. Usable to 5.4 GHz.
Envelope distortion	For a modulation rate of 1 kHz: Less than 1% total harmonic distortion for AM depths up to 30% Less than 3% total harmonic distortion for AM depths up to 80%.
Modulation source	Internal LF generator or external via front panel sockets.
External AM accuracy	With ALC off the modulation is calibrated for an input level of 1.0 V PD RMS sine wave.
External AM 1 dB bandwidth	With modulation ALC off; DC to 30 kHz in DC coupled mode and 10 Hz to 30 kHz in AC coupled mode. Typical modulation bandwidth exceeds 50 kHz.

MODULATION OSCILLATOR

Frequency range	0.1 Hz to 500 kHz (sine wave).
Selection	By keyboard entry of data. Variation by ⇑/⇑ keys and by rotary control.
Indication	7 digits with annunciators.
Resolution	0.1 Hz.

Frequency accuracy	As frequency standard.
Distortion	Less than 0.1% THD in sine wave mode at frequencies up to 20 kHz.
Alternative waveforms	A triangular wave is available in addition to the sine wave for frequencies up to 100 kHz. A square wave is available for frequencies up to 2 kHz (requires Option 006 - Avionics to be fitted).
Signalling tones	The modulation oscillator can be used to generate sequential (up to 16 tones) or sub-audible signalling tones in accordance with EIA, ZVEI1,ZVEI2, DZVEI, CCIR, EURO1, EEA, NATEL and DTMF* standards. Facilities are also available for creating and storing user defined tone systems. *Requires second modulation oscillator (Option 001) to be fitted.

EXTERNAL MODULATION

Two independent inputs on the front panel with BNC connectors, EXT MOD 1 and EXT MOD 2. The modulation is calibrated with 1 V RMS sine wave applied. Input impedance 100 kΩ nominal.

MODULATION ALC

The EXT MOD 1 and EXT MOD 2 modulation inputs can be levelled by an ALC system.

Level range	0.7 V RMS to 1.4 V RMS sine wave.
Distortion	Less than 0.1% additional distortion for frequencies up to 20 kHz at 1 V RMS sine wave (typically less than 0.1% up to 50 kHz).
1 dB bandwidth	Typically 10 Hz to 500 kHz.

LF OUTPUT

Front panel BNC connector. The output may be configured in either LF Generator Mode to give an output from the internal modulation oscillator or in LF Monitor Mode to give an output from the internal modulation signal paths.

Selection	By keyboard entry of data. Variation by ⇑/⇓ keys and by rotary control.
Indication	7 digits with unit annunciators for frequency and 4 digits with unit annunciators for level.
Level	100 µV to 5 V RMS with a load impedance of greater than 600 Ω. 100 µV to 1.4 V RMS with a load impedance of greater than 50 Ω.
Common mode voltage	±0.5 V maximum.
Source impedance	5.6 Ω nominal.
Level accuracy at 1 kHz	With a load impedance of greater than 10 kΩ:- ±5% for levels above 50 mV and ±10% for levels from 500 µV to 50 mV.
Frequency response	Typically better than ±1 dB from 0.1 Hz to 300 kHz.

SWEEP

Control modes	Start/stop values of selected parameter; Number of steps; Time per step.
Step time	1 ms to 10 s per step.
Sweep ramp	Synchronized analogue ramp with an amplitude of nominally 0 V to 10 V peak on rear panel BNC connector.
Markers	5 user selectable markers for frequency or level provide an indication when specified parameter values have been reached. Output 0 V to +5 V nominal from 600 Ω on rear panel BNC socket.
Trigger	Rear panel BNC connector. Applying 0 V or a switch closure starts the sweep or steps the sweep from point to point. Socket is internally connected via 10 kΩ pull-up resistor to +5 V.

FREQUENCY STANDARD

Frequency	10 MHz.
Temperature stability	Better than ±5 in 10^8 over the operating range of 0 to 50°C.
Warm-up time	Within 2 in 10^7 of final frequency within 10 minutes from switch on at 20°C .
Aging rate	Better than 2 in 10^7 per year; better than 5 in 10^{10} per day after 1 month continuous use.
Output	Rear panel BNC socket provides an output at frequencies of 1, 5 or 10 MHz with a nominal 2 V pk-pk level into 50 Ω.
External input	Rear panel BNC socket accepts an input at 1, 5 or 10 MHz with a minimum level of 2 V pk-pk level. Maximum input level 5 V pk-pk.

GPIB INTERFACE

A GPIB interface is fitted. All functions except the supply switch are remotely programmable.

Capabilities	Complies with the following subsets as defined in IEEE Std. 488.2. SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT1, C0, E2.

RADIO FREQUENCY INTERFERENCE

Conforms with the requirements of EEC directive 76/889 and VDE 0871 as to limits of RF interference.

SAFETY

Complies with IEC 348.
UL 1244 approved.

RATED RANGE OF USE
(Over which full specification is met).

Temperature	0 to 55°C.
Humidity	Up to 93% at 40°C.

CONDITIONS OF STORAGE AND TRANSPORT

Temperature	-40°C to +71°C.
Humidity	Up to 93% relative humidity at 40°C.
Altitude	Up to 4600 m (15,000 ft).

POWER REQUIREMENTS

AC supply	Four settings covering 90-115 V, 105-132 V, 188-242 V and 216-265 V. 45 Hz to 400 Hz. 180 VA maximum.

CALIBRATION INTERVAL

2 years.

DIMENSIONS AND WEIGHT

(Over projections but excluding front panel handles):

Height	Width	Depth	Weight
152 mm 6 in	425 mm 16.6 in	525 mm 20.5 in	16.5 kg 36 lb

SECOND MODULATION OSCILLATOR OPTION

Specification as Modulation Oscillator.

PULSE MODULATION OPTION

Modulation modes	Pulse modulation may be used alone or in conjunction with FM, ΦM or Wideband FM.
Switching speed	
All instruments	For carrier frequencies below 1350 MHz less than 15 ns (typically 5 ns). For carrier frequencies below 21.09375 MHz less than 25 ns from 10% to 90%.
2031 only	For carrier frequencies greater than 1350 MHz less than 30 ns (typically 20 ns).
2032 only	For carrier frequencies greater than 1350 MHz less than 20 ns (typically 12 ns).

Control	0 to +1 V for carrier off, +3.5 to +5 V for carrier on.
Maximum input level	+5.0 V.
ON/OFF ratio	Better than 70 dB at the carrier frequency, typically exceeds 80 dB.
Additional level error	Less than ±0.5 dB.
Propogation delay	Typically 80 ns from PULSE INPUT to RF OUTPUT pulse.
Input impedance	50 Ω nominal.

+19 dBm RF OUTPUT LEVEL OPTION

For 2030 model only.

RF OUTPUT	
Range	-138 dBm to +19 dBm. When AM is selected the maximum output level reduces linearly with AM depth to +13 dBm at maximum AM depth.
SPECTRAL PURITY At RF levels up to +7 dBm:	
Harmonics	Better than -27 dBc.

GMSK OPTION

See Annex A

AVIONICS OPTION

See Annex B

DIGITAL AND VECTOR OPTION

See Annex C

RF PROFILES AND COMPLEX SWEEP OPTION

See Annex D

VERSIONS, OPTIONS AND ACCESSORIES

When ordering please quote the full ordering number information.

Ordering numbers	Versions
2030	10 kHz to 1.35 GHz Signal Generator.
2031	10 kHz to 2.7 GHz Signal Generator.
2032	10 kHz to 5.4 GHz Signal Generator.
	Options
Option 001	Second internal modulation oscillator.
Option 002	External pulse modulation.
Option 003	+19 dBm maximum RF output power (available for 2030 only).
Option 005	GMSK Bt 0.3
Option 006	Avionics
Option 007	Digital and vector modulation
Option 008	RF profiles and complex sweep
Option 100	Single fuse version
Option 105	Pulse modulation with slow rise and fall times
	Supplied Accessories
43129-003W	AC supply lead.
46881-976P	Operating Manual for 2030 series.
	Optional Accessories
46881-978M	Service manual (for 2030 series).
43126-012S	RF connector cable, TM 4969/3, 50 Ω, 1.5 m, BNC.
54311-092P	Coaxial adapter N male to BNC female.
59999-163K	Precision coaxial adapter, N male to SMA female.
54411-051X	Impedance adapter, 50 to 75 Ω, BNC connectors.
54311-095C	RF connector cable, 1 m, type N connectors.
43129-189U	GPIB Lead assembly.
46883-408K	IEEE/IEC Adapter block for GPIB socket.
46884-291A	Rack mounting kit (with slides) for rack cabinets with depths from 480 mm to 680 mm.
46884-292Z	Rack Mounting kit (with slides) for rack cabinets with depths from 680 mm to 840 mm.
46884-541Y	Rack mounting kit (without slides).
46884-444G	Maintenance kit for 2030/2040 series
59000-178G	Lab Windows driver for signal generators.
46662-525Y	Carrying case (aluminium)
54499-044F	DECT filter

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GERMAN RFI DECLARATION FOR CLASS B SELF-CERTIFICATION

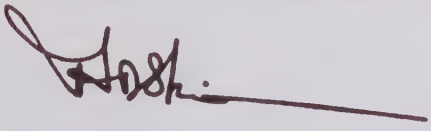
Hiermit wird bescheinigt, dass der AM/FM Signal Generator 2031 in Übereinstimmung mit den Bestimmungen der Vfg 1046/1984 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Marconi Instruments Ltd., Longacres, St. Albans
Hertfordshire, AL4 0JN, UK

English translation:

We hereby certify that the AM/FM Signal Generator 2031 complies with the RFI suppression requirements of Vfg 1046/1984. The German Postal Service was notified that this equipment is being marketed. The German Postal Service has the right to re-test the equipment and verify compliance.



Signed *A D SKINNER* *Head of Measurement Standards*

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Chapter 2
INSTALLATION

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MOUNTING ARRANGEMENTS

Excessive temperatures may affect the performance of the instrument. Completely remove the plastic cover, if one is supplied over the case, and avoid standing the instrument on or close to other equipment which is hot.

CONNECTING TO SUPPLY

Before connecting the instrument to the AC supply, check the setting of the voltage selector switch which is an integral part of the supply connector at the rear of the instrument.

Voltage selector

The selected voltage is displayed in a window at the top of the connector. The instrument is normally despatched with the selector set to 240 V. To select another voltage, insert a screwdriver into the slot at the top of the moulding and twist slightly so that the cover is free to hinge downwards. Rotate the barrel so that the correct setting is displayed, see Fig. 2-1.

Setting	Voltage range
100 V	90 - 115 V
120 V	105 - 132 V
220 V	188 - 242 V
240 V	216 - 265 V

Fuses

The correct fuse rating for each voltage setting is as follows:

100 V to 120 V, 1.6 A-TT (1.6 amp double time lag)

220 V to 240 V, 1 A-TT (1 amp double time lag)

Fuses are cartridge type measuring 20 mm x 5 mm.

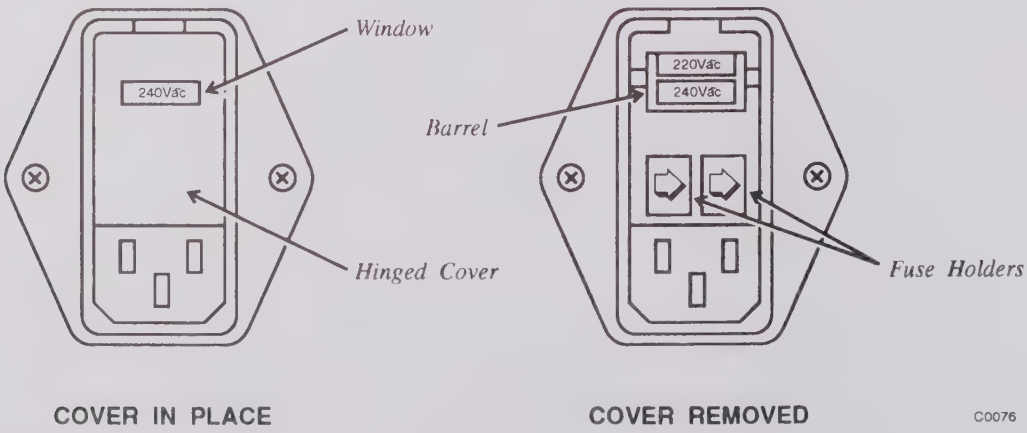

Fig. 2-1 AC connector showing voltage selector and fuse holders

Supply cable

The AC supply cable is fitted at one end with a socket which mates with the AC connector on the rear panel. When fitting a supply plug, ensure that connections are made as follows:

Earth - Green/Yellow
Neutral - Blue
Live - Brown

When attaching the supply lead to a non-soldered plug, it is recommended that the tinned ends of the lead are cut off to avoid intermittent connections resulting from cold flow.

GENERAL PURPOSE INTERFACE BUS (GPIB)

The GPIB interface built into the 2030 series enables the signal generators to be remotely controlled to form part of an automatic measuring system.

GPIB cable connection

Connection to other equipment which has a 24-way connector to IEEE Standard 488 is made using the rear panel GPIB socket. For this purpose, the GPIB cable assembly, available as an optional accessory, (see Chap. 1 'Accessories') may be used.

GPIB connector contact assignments

The contact assignments of the GPIB cable connector and the device connector are as shown in Fig. 2-2.

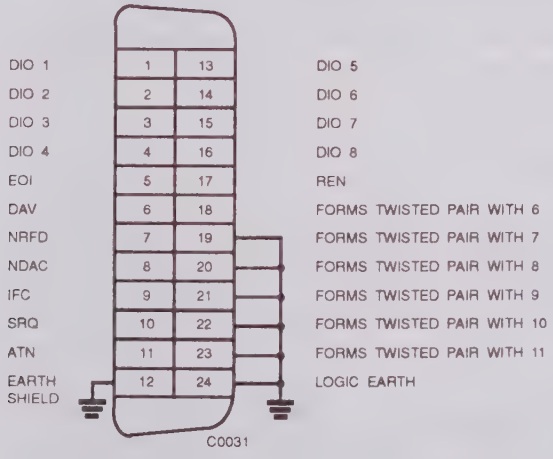

Fig. 2-2 GPIB connector contact assignments

IEEE to IEC conversion

An optional IEEE to IEC adapter is also available (see Chap. 1 'Accessories') for interfacing with systems using a 25-way bus connector to IEC Recommendation 625. The method of use is shown in Fig. 2-3.

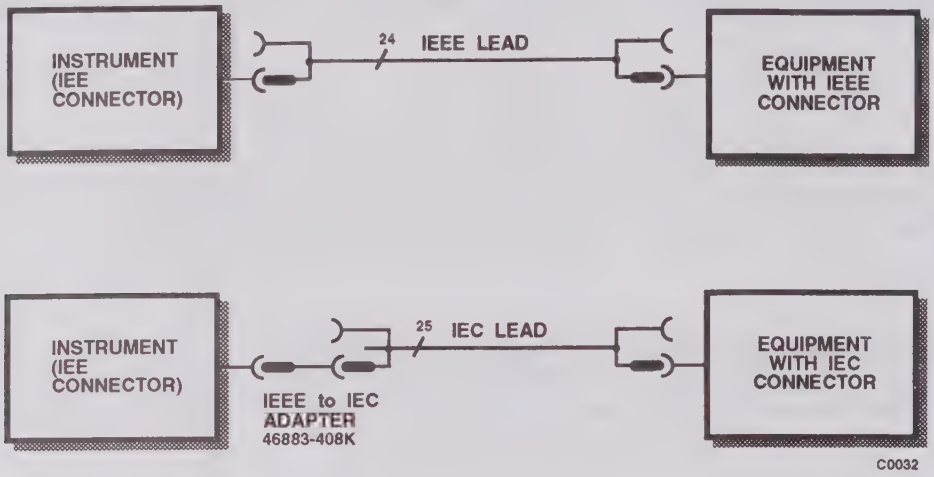

Fig. 2-3 IEEE to IEC conversion

Interface bus connection

The cables for the interface bus use special male-female connectors at both ends. This allows several connectors to be stacked one on top of another permitting several cables to be connected to the same source and secured by a lockscrew mechanism. Too large a stack, however, may form a cantilevered structure which might cause damage and should be avoided. The piggyback arrangement permits star or linear interconnection between the devices with the restriction that the total cable length for the system must be:-

(1) No greater than 20 m (65 ft).

(2) No greater than 2 m (6 ft) times the total number of devices (including the controller) connected to the bus.

RACK MOUNTING

The instrument, which is normally supplied for bench mounting, may be mounted in a standard 19 inch rack (see 'Optional Accessories'). There are two slide rack mounting kits to accommodate different depths of cabinet. These kits include full fitting instructions. A rack mounting kit without slides is also available which contains front panel mounting brackets only.

BATTERY REPLACEMENT

The Lithium battery has an estimated life of 5 years, but it is recommended that it should be replaced every two years. The clock will continue to run for approximately 30 seconds while the replacement is made.

If a Lithium battery is unobtainable an alkaline battery can be used, but will have a shorter life.

Chapter 3-1
OPERATION

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INTRODUCTION

This chapter explains how to:

- Set up the signal generator to produce a typical basic signal.
- Select the main operating parameters; carrier frequency, output level and type of modulation.
- Use the full range of supporting facilities.

CONVENTIONS

The following conventions are used in this chapter:

RF OUTPUT	Capitals refer to titles marked on the panel.
[MEM]	Capitals in square brackets indicate hard key titles.
Int. F4	Italics refer to data or messages on the display.
[Pulse]	Italics in square brackets indicate soft key titles, e.g. *[Pulse]* means the soft key adjacent to the *Pulse* title box at the side of the menu.

FRONT PANEL

Parameters are selected by means of hard keys, which have their function printed on them, soft keys, which do not have any notation, a numerical key pad and a rotary control knob, see Fig. 3-1-1. The hard keys have functions which do not change, whereas the soft key functions are determined by the menu which is being displayed. The numerical keys are used to set parameters to specific values which can also be varied in steps of any size by using the ⇑/⇓ keys or the rotary control knob.

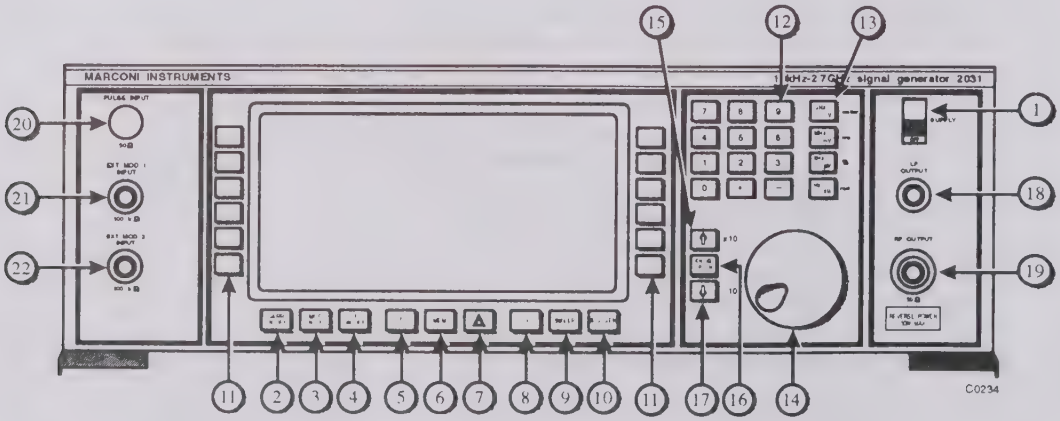

Fig. 3-1-1 2031 front panel.

1)	SUPPLY	Switches the AC supply voltage on and off.
(2)	CARR ON-OFF	Enables or disables the carrier frequency.
(3)	MOD ON-OFF	Enables or disables the modulation.
(4)	LF ON-OFF	Switches the low frequency output on and off.
(5)	UTIL	Displays the utilities menu.
(6)	MEM	Displays the memory store/recall menu.
(7)	Δ	Displays the total shift menu.
(8)	LF	Displays the LF and monitor menus.
(9)	SWEEP	Displays the sweep status menu.
(10)	SIG GEN	Displays the main menu.
(11)	SOFT KEYS;	Twelve function keys change notation as the menu changes.
(12)	NUMERICAL KEY PAD	For changing the value of a selected parameter. Minus sign and decimal point are included.
(13)	UNITS KEYS	Determine the units of set parameters and terminate the numerical entry.
(14)	CONTROL KNOB	When enabled, adjusts the value of the selected parameter.
(15)	⇑ ×10	When knob disabled, increments a selected parameter. When knob enabled, increases knob sensitivity by value of ten.
(16)	KNOB UP-DN	Switches between control knob and ⇑⇓ keys.
(17)	⇑ ÷10	When knob disabled, decrements a selected parameter. When knob enabled, decreases knob sensitivity by value of ten.
(18)	LF OUTPUT	BNC socket provides a low impedance output at the frequency selected at the *LF GENERATOR MENU* or monitors the modulating signal.
(19)	RF OUTPUT	50 Ω N type socket with reverse power protection.
(20)	PULSE INPUT	50 Ω BNC socket (if fitted) accepts a pulsed signal.
(21)	EXT MOD 1 INPUT	100 kΩ BNC socket. An independent input which allows an external modulation signal to be applied
(22)	EXT MOD 2 INPUT	100 kΩ BNC socket, similar to (21).

REAR PANEL

The following facilities are available on the rear panel, see Fig. 3-1-2.

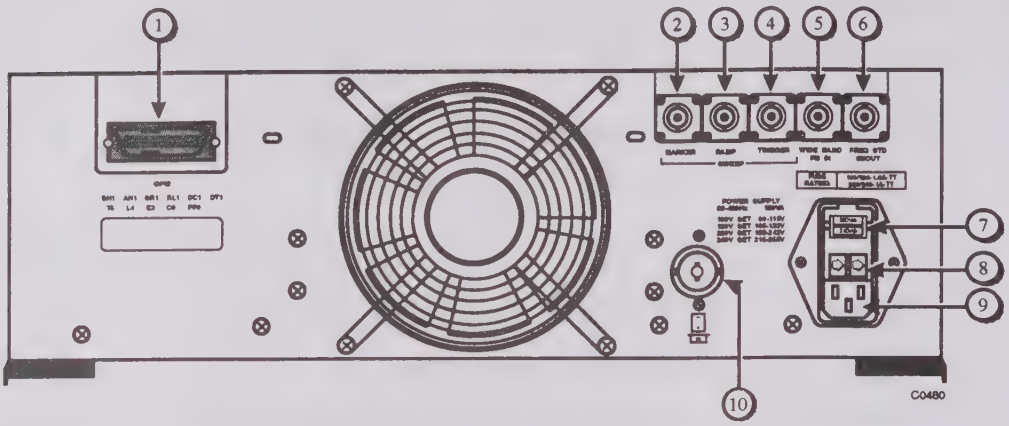

Fig. 3-1-2 2031 rear panel

(1)	GPIB	24 pin socket accepts standard IEEE connector to allow remote control of the instrument.
(2)	SWEEP MARKER	BNC socket supplies sweep marker.
(3)	SWEEP RAMP	BNC socket provides a ramp output at 0 to 10 V peak to peak.
(4)	SWEEP TRIGGER	BNC socket provides access for a trigger input.
(5)	WIDE BAND FM IN	BNC socket accepts a wide bandwidth FM signal into 50 Ω with a typical bandwidth of 10 MHz.
(6)	FREQ STD IN/OUT	BNC socket for standard frequencies at 1, 5, or 10 MHz at TTL levels.
(7)	VOLTAGE SELECTOR	Removable cover reveals barrel which can be rotated to select the required voltage range.
(8)	FUSES	AC fuses rated at 1.6 A (time lag) for the 100 to 120 V range and 1 A (time lag) for the 220 to 240 V range.
(9)	AC SUPPLY INPUT	3 pin plug integral with voltage selector and fuse holders. Mates with supply lead socket.
(10)	BATTERY HOLDER	Houses battery for real time clock.

THE MENUS

The 2030 Series instruments are operated by calling up various displays or menus on the screen. Menus are accessed via both hard and soft keys. Pressing a hard key normally causes the appropriate primary menu to appear on the screen regardless of the current working position within the menu hierarchy. As the display changes from one menu to another, so the 12 soft keys assume those functions necessary to drive the instrument from that menu. Secondary menus are displayed by pressing a soft key while in a primary menu. Some sub-menus are nested e.g. UTILITIES. Clearance from these is obtained by pressing the *[EXIT]* key.

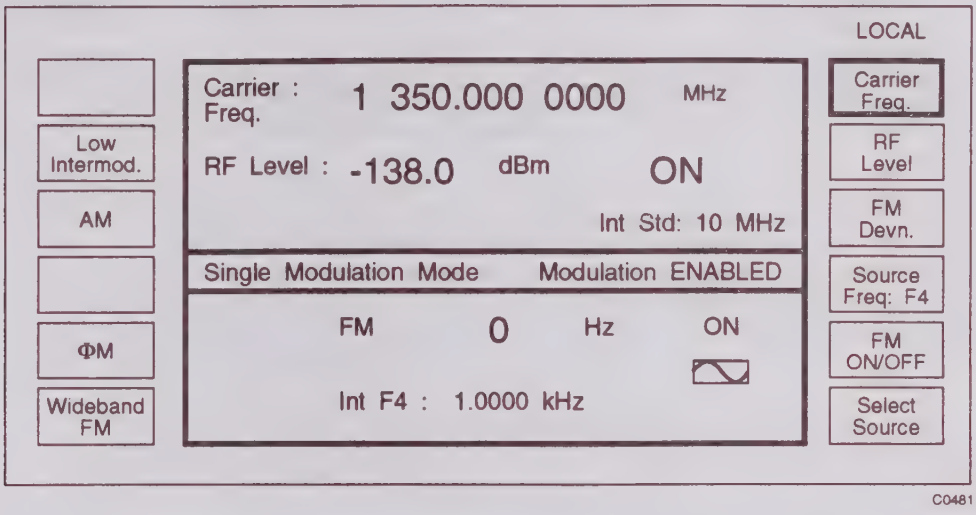

Fig. 3-1-3 Sig Gen menu - default display for 2030

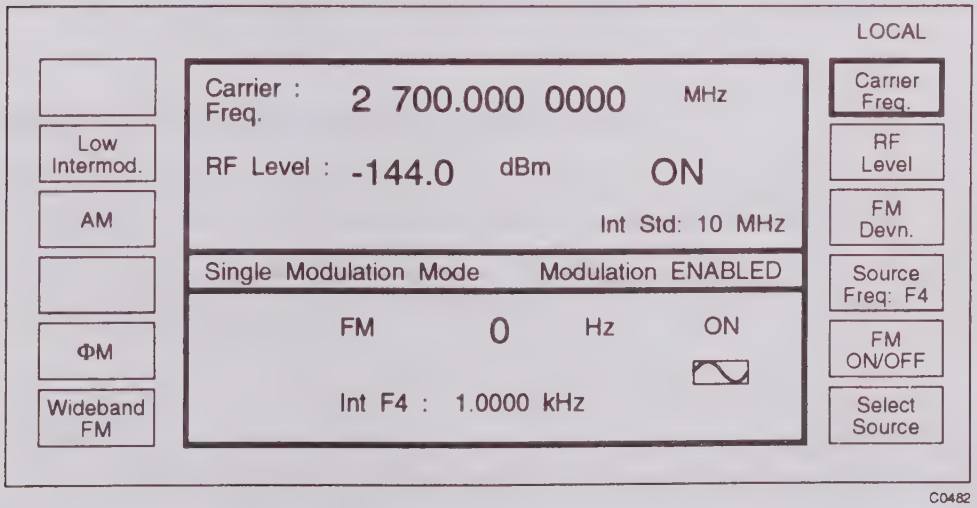

Fig. 3-1-4 Sig Gen menu - default display for 2031

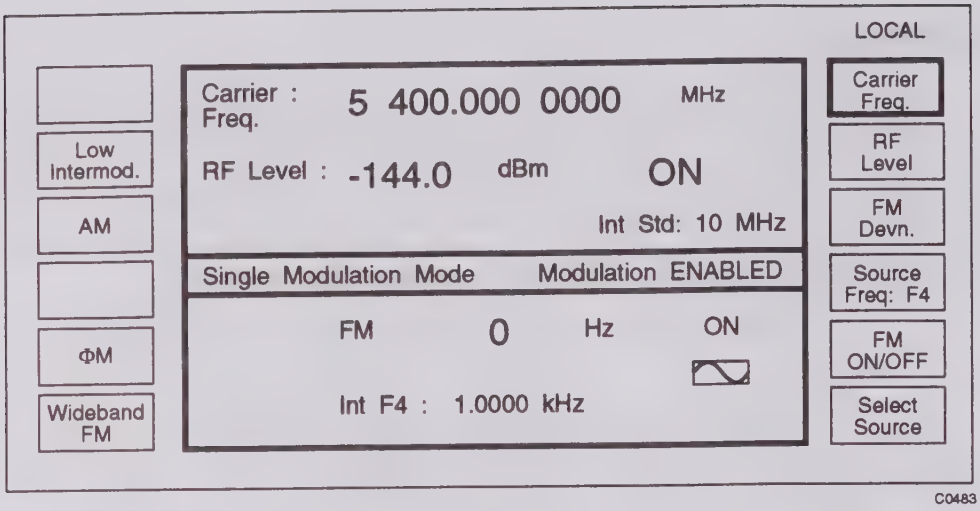

Fig. 3-1-5 Sig Gen menu - default display for 2032

FIRST TIME USE

First time users can quickly become familiar with the principles of control and display by carrying out the following exercise, which demonstrates how to set up a typical basic signal having the following parameters:

Carrier frequency:	100 MHz.
Output level:	10 dBm.
Amplitude modulation:	30% depth at 1 kHz.

Switching on

(1) Before switching the instrument on, check that the voltage selector has been set to the value of the power supply as described in Chap. 2, and that no signal voltage is present on the PULSE INPUT socket.

(2) If the default display shown in Fig. 3-1-3 or Fig. 3-1-4 or Fig. 3-1-5 is not obtained, a previous user may have set the instrument to switch on with one of the user memories recalled rather than using the default factory settings. Before proceeding any further you should reset this selection, see 'Power up options'. Switch off and on again. Alternatively use the MEM key followed by entering 50 and terminating by pressing the [enter] key. This will reset the instrument to the factory default setting.

If the RF level units and the internal/external standard are not as shown, they can be changed as described on Page 3-1-39, 'RF level units' and Page 3-1-37 'Selection of frequency standard'.

(3) Observe that the main menu appears on the display showing default parameters for FM. The soft key label marked *[Carrier Freq.]* is highlighted (i.e. the line bordering the label is increased in thickness to about 1 mm), which means that anything entered at this stage will change the carrier frequency.

(4) If necessary, adjust the display for brightness and contrast, see 'UTILITIES' Page 3-1-34.

Changing the value of the selected parameter

If an error is made when keying in, press the soft key again and key in the correct value. If an error message is displayed, it can be cancelled by entering a value which is within limits.

(1) Using the numerical key pad, enter 100 MHz by pressing keys [1], [0], [0] and the key marked [MHz/mV/ms]. Observe that the Carrier Freq. display changes to *100.000 0000* MHz.

(2) Press *[RF level]*. The *RF level* soft key label is now highlighted.

(3) Using the numerical key pad, enter 10 dBm by pressing keys [1], [0] and the key marked [Hz/dB/rad]. Observe that the RF Level display changes to *10.0 dBm*.

(4) Press *[AM]* on the left hand side of the display. The menu will now change to display AM modulation parameters in the lower panel. The *[FM Devn.]* soft key on the right hand side of the menu changes to *[AM depth]* and this label is now highlighted. *AM* disappears from the left hand side.

(5) Using the numerical key pad, enter 30% AM depth by pressing [3], [0] and [kHz/μV/%]. Observe that the *AM* depth display changes to *30%*. The display will now be as in Fig. 3-1-6 and the selected signal will now be present at the RF OUTPUT socket.

Enabling or disabling the modulation

The modulation is ON by default, but the AM can be turned ON and OFF by pressing *[AM ON/OFF]* at the right hand side of the display and the modulation can be enabled or disabled by pressing [MOD ON-OFF]. These are both toggle actions, i.e. press ON, press OFF. The soft key acts only on the selected modulation whereas the [MOD ON-OFF] acts on all modulations.

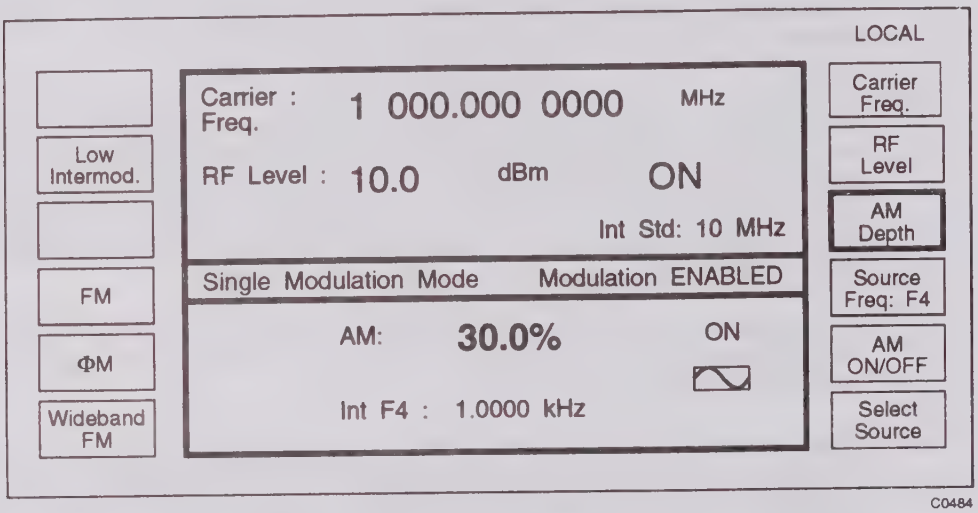

Fig. 3-1-6 Amplitude modulation - menu configuration

Using the [⇑ ×10] and [⇓ ÷10] keys

When a parameter has been selected via the numerical key pad, its value can be incremented or decremented either in steps using the [⇑] key and the [⇓] key, or continously with the control knob. Select *[Carrier Freq.]* and observe that the effect of pressing the [⇑] and [⇓] keys is to change the carrier frequency in steps of 1 kHz. Default step sizes are assigned to all parameters but these can be changed, see Page 3-1-27, 'INCREMENTING (using the delta function)'.

Using the control knob

(1) Press [KNOB UP-DN] to enable the control knob.

(2) On the display, brackets will appear above and below the selected parameter. These brackets embrace the part of the value which the control knob can change. Pressing the [×10] key shortens the bracket length by one decimal place. Pressing the [÷10] key increases the bracket length by one decimal place. In this way the sensitivity of the control knob can be increased or decreased by a factor of ten

(3) Rotate the control knob and observe the change in the selected parameter. Press [KNOB UP-DN] to disable the knob.

(4) For other parameters, press the relevant soft key and use the [⇑] and [⇓] keys or the control knob.

Note...

For *RF Level* the knob resolution is fixed at 0.1 dB.

DETAILED OPERATION

CARRIER FREQUENCY

The carrier frequency is selected from the main menu by pressing *[Carrier Freq]*, unless it is already highlighted as in the default display.

Enter the required value via the numerical key pad. The value can then be incremented or decremented using the control knob and its associated keys, [KNOB UP-DN], [×10] and [÷10].

If a value outside the specified range is requested, the message:

ERROR 51: Carrier Outside Limits

is displayed on the screen when the terminator key is pressed, and the instrument is automatically set to the end of the range.

Carrier ON/OFF

The carrier may be switched *ON* or *OFF* at any time via the [CARR ON-OFF] key. This effectively switches the output ON and OFF, retaining the 50 Ω output impedance.

OUTPUT LEVEL

The output level is selected at the Sig Gen menu by pressing *[RF Level]* and entering the required value on the numerical key pad. If a value outside the specified range is requested the message:

ERROR 52: RF Level Outside Limits
or
ERROR 17: RF Level limited by AM

is displayed and the instrument is automatically set to the end of the range.

Choice of units

Units may be μV, mV, V or dB. Conversion between dB and the voltage units is carried out by pressing the appropriate units key, i.e. to change dBm to a voltage unit, press any voltage key for the correct conversion. The choice of Volts EMF, Volts PD, and the dB reference is made by using the *[RF Level Units]* utility, see Page 3-1-39, 'RF level units'.

Reverse power protection

Accidental application of power to the RF OUTPUT socket trips the reverse power protection circuit (RPP) and a flashing message appears on the display, see Fig. 3-1-7.

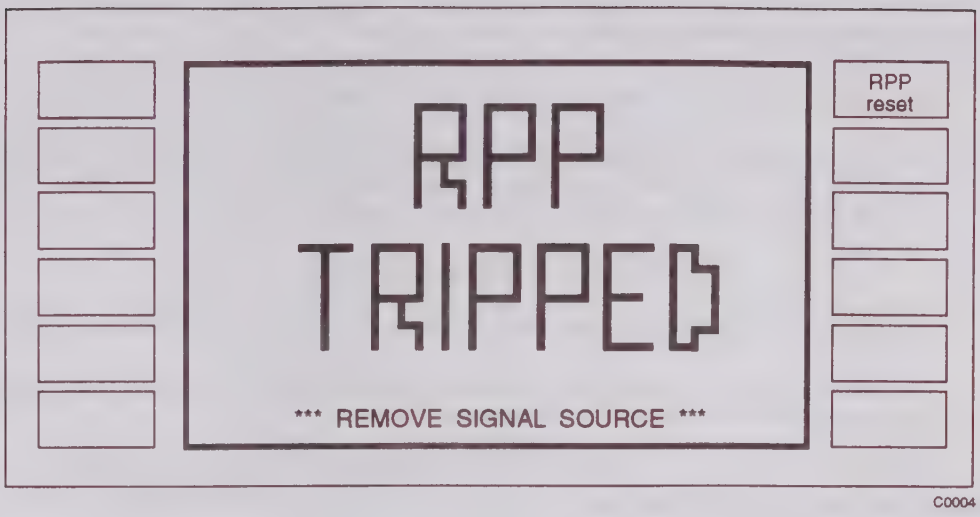

Fig. 3-1-7 RPP tripped

Pressing *[RPP Reset]* resets the RPP and returns the display to the menu in use when the reverse power protection was tripped. If *[RPP Reset]* is pressed with the signal still applied, the RPP will trip again.

MODULATION

The carrier can be frequency, amplitude, or phase modulated, with pulse modulation as an option. The internal modulation oscillator has a frequency range of 0.1 Hz to 500 kHz, with a resolution of 0.1 Hz.

Selecting the modulation

The type of modulation required, AM, FM, ΦM, wideband and optional pulse modulation can be selected by soft keys at the main menu. Four modulation modes are available, see Page 3-1-19, 'Modulation mode selection'.

Modulation ON/OFF

[MOD ON-OFF] switches all modulation *ON* or *OFF* and the condition is indicated in the centre of the main display, e.g:

Modulation DISABLED

Modulation is also controlled by a soft key which turns the selected modulation on and off. For modulation to appear on the carrier, modulation must be both enabled with the [MOD ON-OFF] hard key and turned on via the soft key. In single modulation modes the [MOD ON-OFF] key and the *[FM ON/OFF]*, *[AM ON/OFF]*, *[ΦM ON/OFF]* keys appear to carry out the same function, but the action is different, particularly in the FM mode. The *[FM ON/OFF]* etc. soft keys only reduce the modulation to zero whereas the [MOD ON-OFF] key completely disables the modulation system such that the instrument reverts to a carrier frequency generator.

Selecting amplitude modulation

(1) At the Sig Gen menu, press *[AM]*, the *[AM Depth]* box is now highlighted.

(2) Enter the required modulation depth via the numerical key pad and terminate with the [%] key. If the modulation depth requested exceeds 99.9%, the depth is reset to the maximum value available and the message:

ERROR 56: AM Outside Limits

is displayed at the top of the screen.

(3) Switch the AM ON or OFF by pressing *[AM ON/OFF]*. The AM information is displayed in the lower half of the screen.

Selecting frequency modulation

(1) At the Sig Gen menu, press *[FM]*, the *[FM Devn.]* box will be highlighted.

(2) Enter the FM deviation value via the numerical key pad and terminate it with [Hz], [kHz] or [MHz].

(3) Switch the FM ON or OFF via *[FM ON/OFF]*. The FM information is displayed in the lower half of the screen.

Selecting phase modulation

(1) At the Sig Gen menu, press *[ΦM]*. The *[ΦM Devn.]* box will be highlighted.

(2) Enter the phase modulation deviation value via the numeric key pad and terminate it with the [RAD] key.

(3) Switch the ΦM ON or OFF via the *[ΦM ON/OFF]* key. The ΦM information is displayed in the lower half of the screen.

Selecting wideband frequency modulation

(1) At the Sig Gen menu, press *[Wideband FM]*. The *[Wideband FM]* box will be highlighted.

(2) The value can be changed via the key pad and frequency terminator key. To preserve the widest bandwidth, the control of the wideband FM is carried out in a series of fixed steps and the signal generator automatically displays the calculated fixed step which is closest to the keyed in value. Applying a 1 V RMS sine wave to the rear panel WIDE BAND FM IN socket will produce the indicated deviation.

(3) Pressing *[AC/DC Coupling]* changes the coupling from AC to DC and vice versa. When the input is DC coupled, small frequency offsets can be reduced by using the nulling facility. Nulling can be effected by pressing *[DCFM Nulling]*. The legend:

**** DCFM NULLING ****

appears briefly on the display.

Note...

The [⇑] and [⇓] keys and the control knob do not operate for wideband FM.

CAUTION

The WBFM socket input impedance is 50 Ω. The DC component of of any applied voltage must not exceed 5 V.

Modulation source frequency

(1) At the Sig Gen menu press *[Source Freq.]*.

(2) Enter the required source frequency and terminate the entry with [Hz], [kHz] or [MHz].

Note...

When the modulation source is operating as a continuous signalling tone the *[Source Freq.]* legend is replaced with the *[Tone Number]*. Pressing the key allows a new tone number to be entered.

Source selection - internal

The modulation source may be selected by pressing *[Select Source]*. Sources may be internal or external. If the currently selected source is internal, the *Internal Source Selection Menu* is displayed, giving a choice of six frequencies, F1-F6, see Fig. 3-1-8. The frequency assigned to the highlighted F number may be changed by the numerical key pad and terminated with [Hz], [kHz], [MHz] or [GHz]. Soft keys allow the selection of either a sine or triangular waveform. The selection of sub-audible continuous tones can be achieved by pressing *[CTCSS]*, see 'SIGNALLING'. Pressing *[Mod. Src Phase]* displays the *LF Source Phase Control* menu, see Fig. 3-1-9. The LF source phase angle can be varied from -180° to +180°. The pictograms at the end of each line show a symbolic sine wave when a source is selected. This changes to a triangular wave if *[Triangle Wave]* is selected. These symbols also appear on the main menu. A horizontal bar is shown when a source is not selected or is not available.

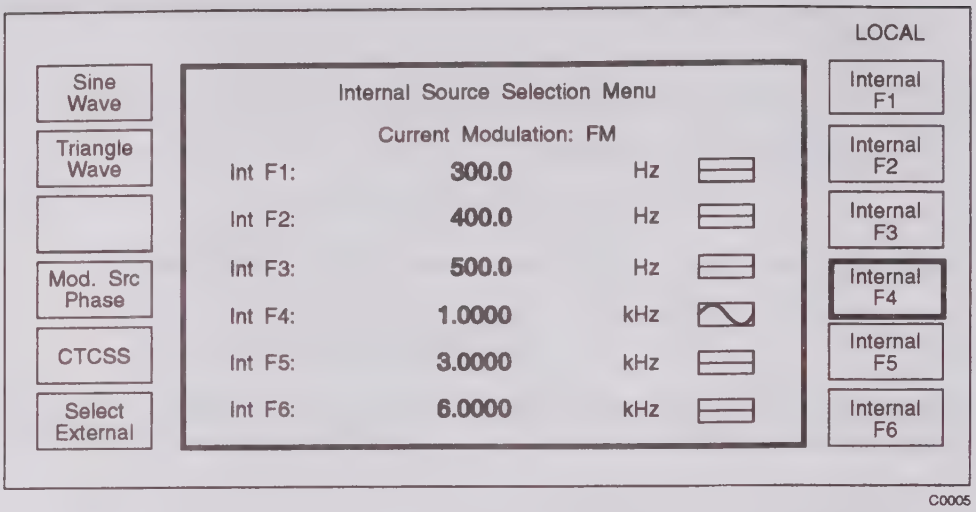

Fig. 3-1-8 Internal source selection menu

LF phase

When an internal source has been selected, its phase relative to the second modulation oscillator (if fitted) can be changed by pressing *[Mod. Src Phase]* and entering the required value. Where two internal modulation frequencies are active, the starting phase difference between the two signals can be set up and the phase angle is referred to the currently selected oscillator.

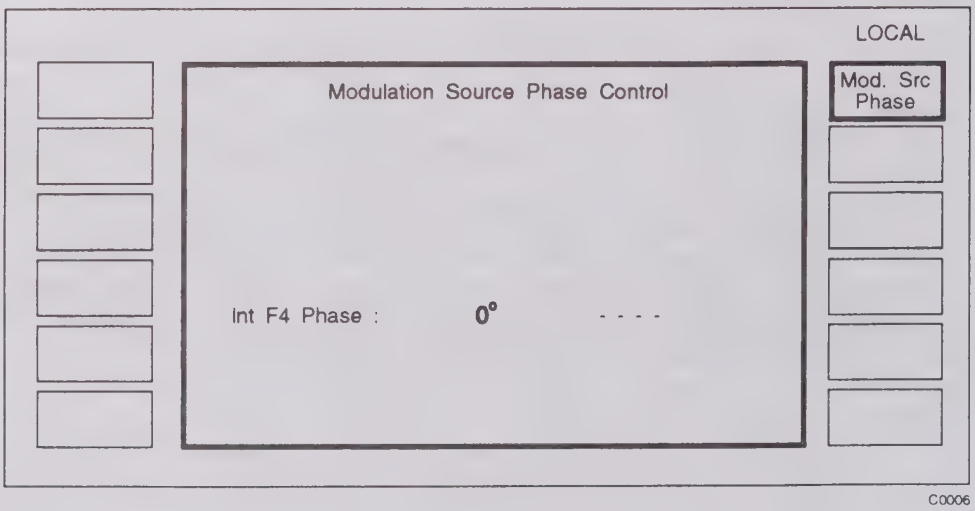

Fig. 3-1-9 LF phase control

Source selection - external

An external source may be selected by pressing *[Select External]*. The *External Source Selection Menu* is then displayed on the screen (This menu is displayed immediately when pressing *[Select Source]* if the currently selected source is external). This menu allows the choice of two input sockets Ext Mod 1 and Ext Mod 2 and AC, ALC, or DC coupling by pressing the appropriate soft key. The pictograms at the end of each line show a symbolic arbitrary waveform when an external source is selected. This symbol also appears on the main menu. A horizontal bar is shown when a source is not selected or is not available. When the input is DC coupled, small frequency offsets can be reduced by using the nulling facility. Nulling can be effected by pressing *[DCFM Nulling]*.

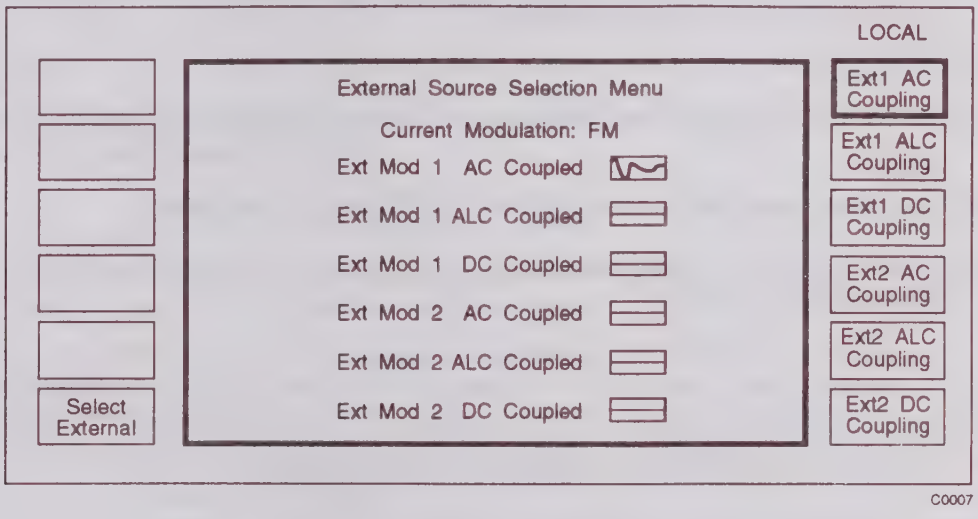

Fig. 3-1-10 External source selection menu

Low intermodulation mode

When carrying out intermodulation tests the output signal from two signal generators is combined using a resistive or hybrid combiner. If the carrier frequencies are relatively close together each generator will receive an interfering signal from the other source. The RF ALC system will detect a beat frequency equal to the difference in carrier frequencies and attempt to apply AM in order to cancel the signal. In so doing the RF ALC system will generate AM sidebands which are indistinguishable from intermodulation products. By using the low intermodulation mode the RF ALC system can be disabled to prevent the injection of AM sidebands.

If pulse modulation is not fitted proceed as follows:

(1) At the Sig Gen menu press *[Low Intermod]*.

(2) This causes either *Low Intermodulation Disabled* or *Low Intermodulation Enabled* to be displayed in the lower panel.

(3) Press the [MOD ON-OFF] key to toggle between the enabled and disabled states.

(4) If an attempt is made to *[Set Steps]* from the Δ menu, the message *Low Intermod: No Steps Allowed* will be displayed.

If pulse modulation (Option 002) is fitted proceed as follows:

(1) Press the *[Pulse Mod]* key.

(2) This causes the message *PULSE ON* to be displayed.

(3) Press the *[Pulse ON/OFF]* key.

(4) This causes *PULSE OFF* to be displayed together with *Low Intermodulation Disabled* or *Low Intermodulation Enabled* shown in the lower panel.

(5) Press the [MOD ON-OFF] key to toggle between the enabled and disabled states.

(6) If an attempt is made to *[Set Steps]* from the Δ menu, the message *PULSE : No Steps Allowed* will be displayed.

Note...

AM is not available in the Pulse Modulation or Low Intermodulation modes of operation.

Selecting pulse modulation (applies if Option 002 is fitted)

(1) At the Sig Gen menu, press *[Pulse Mod]*, when the Pulse Mod box on the display will be highlighted.

(2) Selecting and Enabling Pulse Mod changes the RF level control loop to the Direct Level Control mode, which can take up to 100 ms to action. For best accuracy, this process should be repeated before measurements are taken if neither the Carrier Frequency or RF Level have been changed recently. When Pulse Mod is disabled the RF Level is controlled in the normal way.

(3) Switch Pulse Mod on or off with the *[Pulse On/Off]* key. When 'On', the carrier is controlled by the logic level applied to the Pulse Input socket mounted on the front panel. A logical '1' (a voltage between 3.5 and 5 V) allows Carrier Output, a logical '0' (a voltage between 0 and 1.0 V) suppresses it. Turning Pulse Mod off effectively applies a logical '1' allowing Carrier Output.

MODULATION ALC

The automatic levelling control (ALC) is used in conjunction with an external source and can be disabled when not required. To enable the ALC, proceed as follows:

(1) At the Sig Gen menu, press *[Select Source]*. The display will show the *Internal or External Source Selection Menu* (Fig. 3-1-8 or Fig. 3-1-10).

(2) If necessary press *[Select External]* to obtain the *External Source Selection Menu* (Fig. 3-1-10).

(3) Select the required external source from the options shown, e.g. *[Ext 1 ALC Coupling]* or *[Ext 2 ALC Coupling]*. The pictogram at the end of each line will change from a horizontal line to an arbitrary waveform symbol when the source is selected.

(4) Return to the Sig Gen menu by pressing [SIG GEN]. The legend *Ext Mod 1 (or 2) ALC coupled* appears at the bottom of the display.

(5) Apply a signal to the EXT MOD 1 or EXT MOD 2 input socket and vary the level. If the input applied to the external modulation socket is outside the ALC range (at least 0.7 to 1.4 V RMS) *HI LO* will be indicated and an error message will be displayed at the top of the screen. If the level is within the required range, the arbitrary waveform symbol will appear alongside the modulation value.

MODULATION MODES

Two independent inputs on the front panel allow external modulation signals to be summed with signals from the internal oscillator and a second optional internal oscillator (if fitted). Thus up to four modulations may be available at one time. These can be combined to give single, dual, composite and dual composite modes.

Single

In the single mode, only one modulation can be active at any one time, and selecting another modulation cancels the first.

Dual

In the dual mode, a common carrier wave is modulated by two different types of modulation, e.g. one AM and one FM. Each type of modulation carries separate information.

Composite

This mode consists of two modulating channels with similar types of modulation, the effective modulation being the sum of the two waveforms e.g. FM1 + FM2. This mode cannot be used for pulse or wideband modulation.

Dual composite

This mode is similar to single composite with each of the two modulating channels being the sum of two sources, e.g. FM1 + FM2 and AM1 + AM2.

Modulation mode selection

In order to select a different modulation mode;

(1) Press [UTIL]. *Utilities Selection Menu 1* will appear on the display.

(2) Press *[Mod'n Mode]*. The display changes to show the four options. Press the required soft key.

(3) Press [SIG GEN] to return to the Sig Gen menu where the modulation mode and individual source parameters will be shown.

Note...

Full information on the range of utilities can be found under 'UTILITIES'.

Setting the modulation

(1) Select the required modulation channel by pressing the relevant soft key, e.g. *[FM1]* or *[FM2]*. The box containing the parameters for the selected channel is now highlighted, see Fig. 3-1-11.

(2) At this point, the modulation frequency, deviation or depth can be altered. The source frequency can also be changed by pressing *[Source Freq:Fn]* and entering the value in the usual way.

(3) The source can be changed from internal to external or vice versa by pressing *[Select Source]* for the relevant source selection menu.

(4) When an internal source has been selected, its phase can be changed by pressing *[Mod. Src Phase]* and entering the required value. Where two internal modulation frequencies are active, the starting phase difference between the two signals can be set up and the phase angle is referred to the currently selected oscillator.

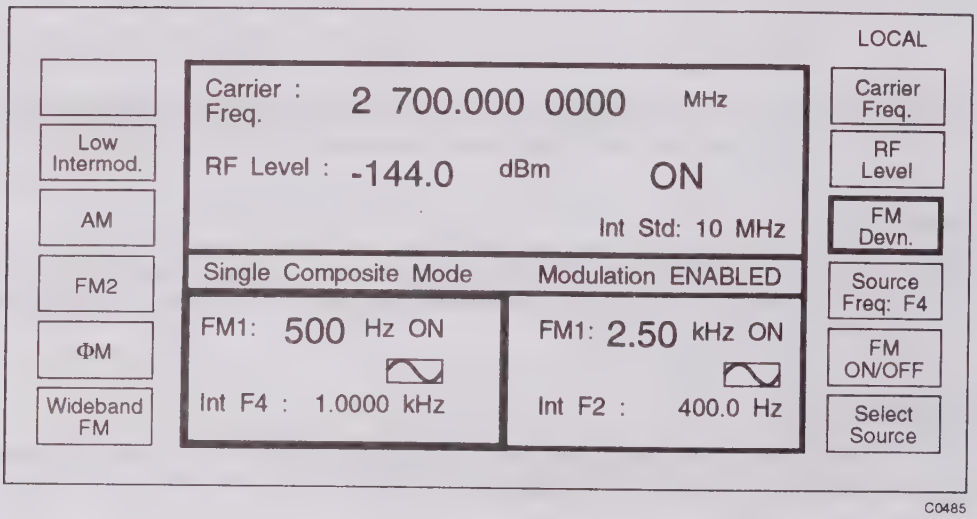

Fig. 3-1-11 Sig Gen menu with two modulation channels

CONTINUOUS TONE SIGNALLING (CTCSS)

A CTCSS tone is any one of 32 standard sub-audible tones ranging from 67 Hz to 250.3 Hz and would generally be used in conjunction with an audible modulation signal in a composite modulation mode. The procedure for initiating these tones is as follows:

Tone selection

(1) At the Sig Gen menu, press *[Select Source]*.

(2) At the *Internal Source Selection Menu*, press *[CTCSS]*. The *Continuous Tone Selection Menu* is now displayed, see Fig 3-1-12.

(3) Key in the required tone number (0 to 15) and press [enter].

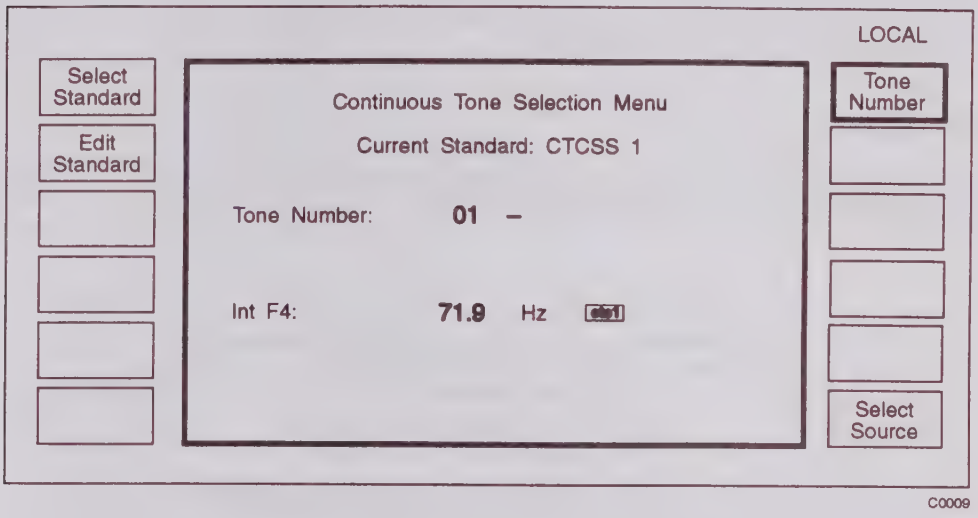

Fig. 3-1-12 Continuous tone selection menu

Selecting alternative tone standards

A list of the 16 tones of the current standard is available by pressing *[Select Standard]*. This action displays the *Tone Standard Selection Menu* with the current standard highlighted. To select from further lists of 16 tones, press *[CTCSS2]* or [USER]. The *Tone Standard Selection Menu* changes to show the new list.

Editing a tone standard

Pressing *[TEMP]* displays a further list of 16 tones set to the default value of 10 Hz. The standard can be edited by selecting *[Edit Standard]* from the menu in Fig. 3-1-12. This gives you the *Continuous Tone Edit Utility* menu.

CTCSS 1, CTCSS 2 or USER can be be loaded to TEMP, which is a volatile store of 16 tones set at a default value of 10 Hz at switch on. Tones can then be changed by using *[Tone No]*, *[Tone Freq]*, *[Next Tone]* or *[Previous Tone]*. When the required changes have been made, the new standard can be saved by pressing *[Store to User]*. *USER* then becomes a user defined standard.

Note...

Selecting *[CTCSS1]*, *[CTCSS2]*, *[USER]* or *[TEMP]* from the *Tone Standard Selection Menu* causes the pictogram in the *Continuous Tone Selection Menu* and the *Internal Source Selection Menu* to change e.g. *ctc1*. The pictogram is repeated in the modulation section of the Sig Gen menu.

SIGNALLING (Sequential Calling Tones)

There are eight sequential calling tone standards available, each having 16 set tones, see Tone Standard Selection Menu, Fig. 3-1-16. They are, CCIR, EURO, DZVEI, ZVEI1, ZVEI2, EEA, EIA and NATEL. There is also provision for the user to define sets of user tones in USER1 and USER2. DTMF signalling tones can also be generated if the second modulation oscillator (Option 001) is fitted.

Sequential calling tones are set up from a utility menu, Fig. 3-1-26, and are activated by pressing *[Send Tones]* which appears on the main menu after the tones have been set up. *[Send Tones]* also appears on the calling tones menu.

Tone selection

Pressing the *[Calling Tones]* soft key at *Utilities Selection Menu 1* calls up the *Sequential Calling Tones Utility* menu, see Fig. 3-1-13.

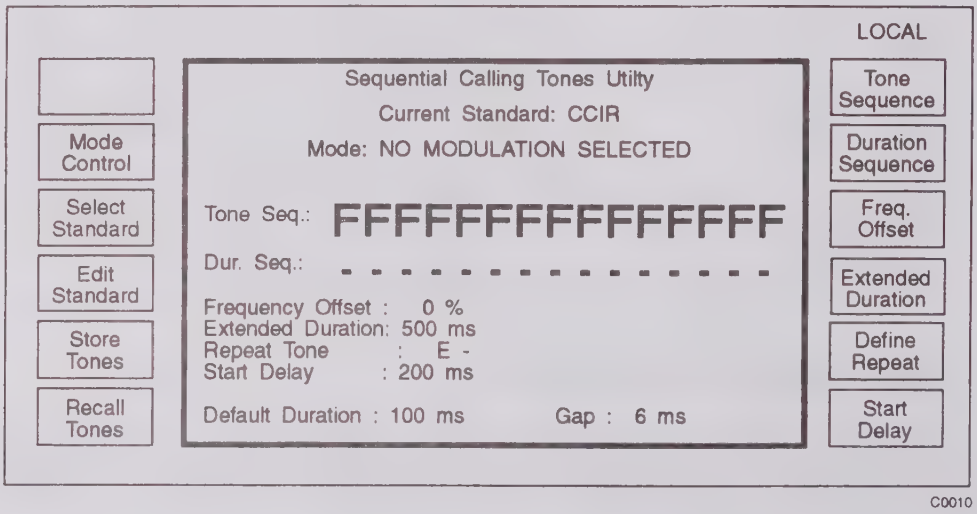

Fig. 3-1-13 Sequential calling tones utility menu

[Tone Sequence] Pressing this key causes hexadecimal data entry keys to appear at the left-hand side of the menu. To change the sequence, enter the tone numbers via the digits 0-9 on the numerical keypad and the soft keys *[A]* to *[F]* and press [enter].

[Duration Sequence] Pressing this key causes *[Default Duration]* and *[Extended Duration]* to appear at the left hand side of the menu. Press either key in turn to set the duration of tones in the sequence. A dash (-) indicates the default duration and E indicates an extended duration. These two keys disappear when [enter] is pressed.

[Define Repeat] allows a repeat tone to be defined, by using the [A] to [F] keys and the keypad and pressing enter. For example, if the repeat tone is defined as tone C, the sequence 11111 will be sent as 1C1C1 so that the receiver decoders will sense a change in frequency at the start of each digit sent.

[Freq. Offset] This facility alters the nominal tone frequency by a set percentage (up to ±10%) for use in tolerance testing. To change the frequency offset value, select *[Freq. Offset]* and enter the new value on the key pad. Terminate with the [%] key.

[Store Tones] Up to 20 sequence set-ups can be stored. Use the keypad to enter the store location number and press [enter].

[Recall Tones] To recall a tone sequence, use the key pad to select the required store location and press [enter].

[Start Delay] The delay before the tone sequence starts and the gap between sequences can be adjusted by pressing this soft key, entering the required delay time on the keypad and pressing [ms].

[Mode Control] Pressing this enables the user to assign the calling tones to a selected type of modulation, see Fig. 3-1-15. Modulation, on the selected channel, is turned off when the tones are triggered and restored after the tones have been sent. Modulation on other channels is not affected by the calling tones and this allows sequential signalling tones to be combined with sub-audible tones. *[NO mod]* This option effectively inhibits sequential tones. The tone sequence can be sent between 1 and 9 times, set by *[No. of Repeats]*, every time the *[Send Tones]* key is pressed. Setting the number of repeats to 10 allows the tones to be sent continually under control of the *[Send Tones]/[Stop Tones]* key at the main menu.

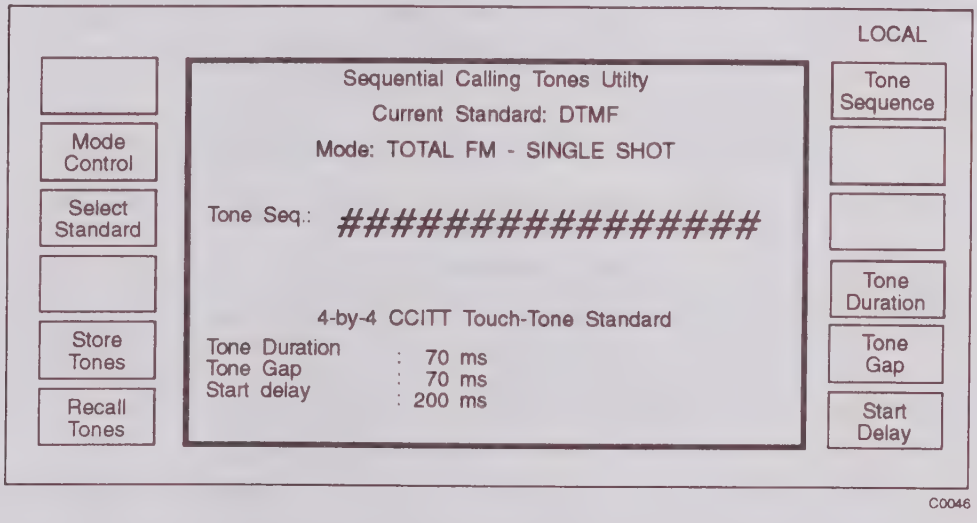

Fig. 3-1-14 Sequential calling tones utility menu (DTMF mode)

On 2030 series fitted with the second modulation oscillator (Option 001) the DTMF signalling capability is also provided. If this standard is selected then the main menu accessed after pressing *the [Calling Tones]* soft key at *Utilities Selection Menu 1* will be as shown in Fig. 3-1-14. The functions of the soft keys are as follows:

[Tone Sequence] Pressing this key allows a tone sequence to be set up using the digits 0-9 on the numerical keypad and the soft keys *[A]*, *[B]*, *[C]*, *[D]*, *[*]* and *[#]*. The sequence entry is terminated by pressing [enter].

[Tone Duration] The default duration of 70 ms for each tone in the sequence can be changed by pressing this key, entering the required duration value and pressing [ms].

[Tone Gap] The default gap duration of 70 ms between each tone in the sequence can be changed by pressing this key, entering the required gap length and pressing [ms].

[Start Delay] The delay before the tone sequence starts and the gap between sequences can be adjusted by pressing this soft key, entering the required delay time on the keypad and pressing [ms].

[Mode Control] Pressing this enables the user to assign the calling tones to a selected type of modulation, see Fig. 3-1-15. Modulation, on the selected channel, is turned off when the tones are triggered and restored after the tones have been sent. Modulation on other channels is not affected by the calling tones and this allows sequential signalling tones to be combined with sub-audible tones. *[NO mod]* This option effectively inhibits sequential tones. The tone sequence can be sent between 1 and 9 times, set by *[No. of Repeats]*, every time the *[Send Tones]* key is pressed. Setting the number of repeats to 10 allows the tones to be sent continually under control of the *[Send Tones]/[Stop Tones]* key at the main menu.

[Select Standard] Selection of alternative signalling standards is achieved by pressing this key to access the *Select Standard Menu*.

[Store Tones] Up to 20 sequence set-ups can be stored. Use the keypad to enter the store location number and press [enter].

[Recall Tones] To recall a tone sequence, use the key pad to select the required store location and press [enter].

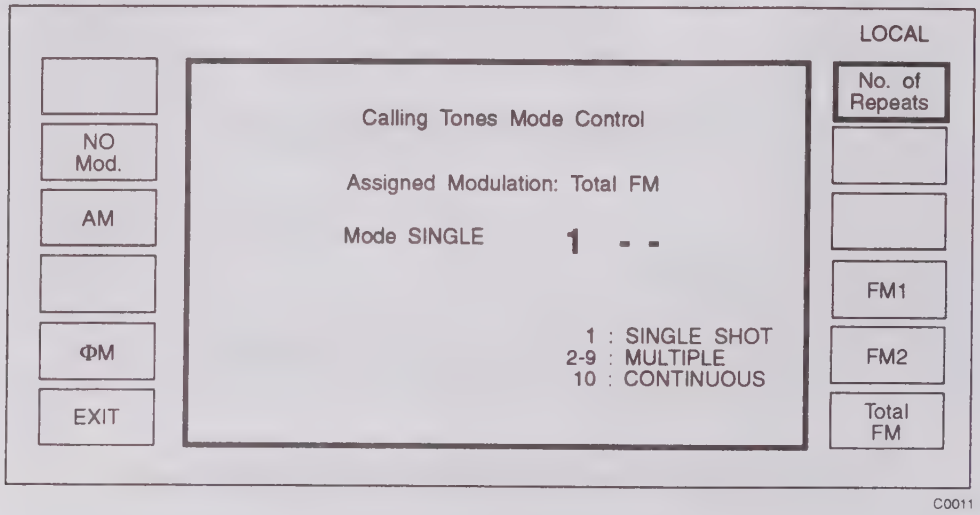

Fig. 3-1-15 Calling tones mode control menu (with [FM] selected)

Selecting alternative tone standards

The *[Select Standard]* key causes the *Tone Standard Selection Menu* to be displayed, see Fig. 3-1-16

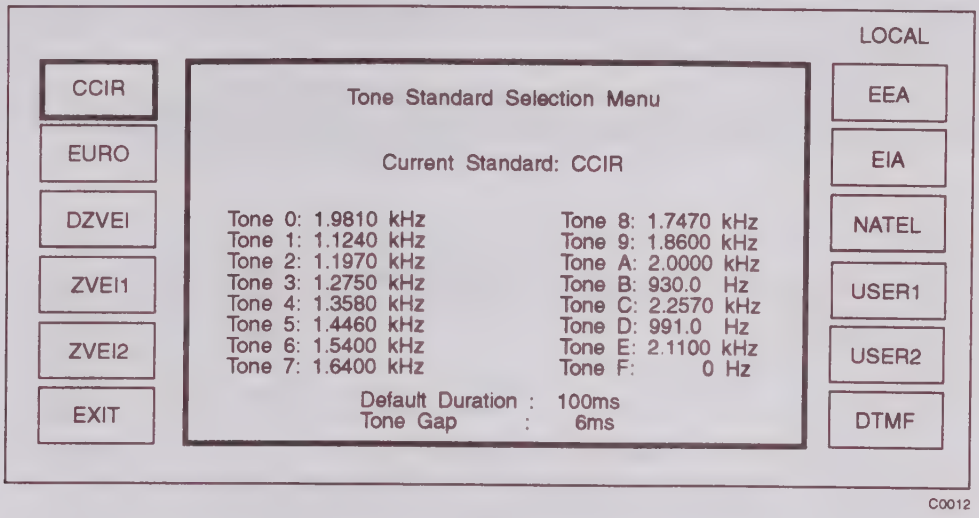

Fig. 3-1-16 Tone standard selection menu

The tone sequential standard to be used is selected by pressing the appropriate soft key. This menu also shows the frequency and timing characteristics for each tone in the standard. User 1 and User 2 are user defined tone standards stored in non-volatile memory. The *[DTMF]* soft key only appears on the display if the instrument is fitted with a second modulation oscillator (Option 001 fitted). If only a single oscillator is fitted the *[DTMF]* key is left blank

Editing a tone standard

Pressing the *[Edit Standard]* key when in the *Sequential Calling Tones Utility* menu (Fig 3-1-13) will produce the *Edit Sequential Tones* Utility, see Fig. 3-1-17, which allows a user defined tone system to be set up.

All editing is carried out in a tone standard called TEMP which is not stored beyond switch off. To ensure that the alterations are available for future use the newly defined tone standard must be saved to non-volatile storage in either USER1 or USER2.

The editing facility allows the user to define the frequency of each of the 16 tones in the system and to set the default duration of each tone in the sequence and the gap between tones (if any). All other settings are handled in the normal *Sequential Tones Utility* menu.

The currently selected tone standard may be copied into the TEMP working space using the top left soft key (shown *[CCIR to TEMP]* in Fig. 3-1-17) and often this is a convenient way to start, particularly when the user defined system is similar to one of the standard systems.

To edit the system in TEMP use *[Tone Number]* to select the number of the tone to be edited (0 to 15) and after pressing *[Tone Freq.]* enter the new frequency to be assigned to this tone number. Select other tones in the system by means to the *[Tone Number]* key or use the *[Next Tone]* and *[Previous Tone]* keys to step through the list. Enter the frequencies of the tones and then use *[Default Duration]* and *[Tone Gap]* to set the times in milliseconds for the default duration of each tone and the gap between each tone.

Finally store the user defined tone system parameters in USER1 or USER2 by pressing *[Store to USER1]* or *[Store to User2].*

Note that when using the DTMF tone signalling capability no editing facility is provided. Changes to the default settings are made directly on the *Calling Tones Utility Menu.*

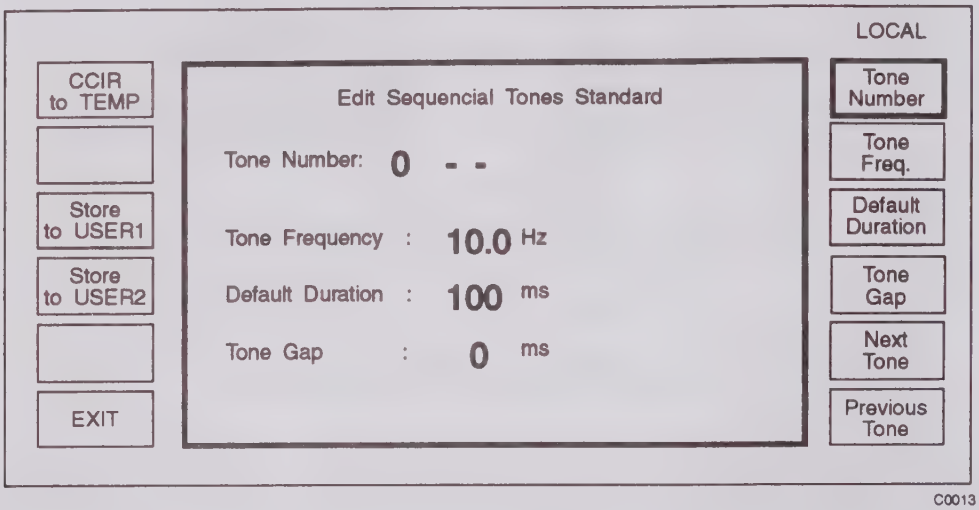

Fig. 3-1-17 Edit sequential tones standard menu

INCREMENTING (using Δ)

Displaying shifts

Press the [Δ] hard key. The total shift menu is displayed as shown in Fig. 3-1-18. This menu displays the difference between the current value and the keyed-in value. Parameters can be incremented or decremented by using the [⇑] or [⇓] key or the control knob, see 'Using the control knob' on Page 3-1-10. To cancel any changes made by the rotary control or the ⇑/⇓ keys, press *[Return Value]*. This will restore the setting of the selected parameter to the keyed-in value, i.e. the indicated shift will return to zero. Pressing *[Transfer Value]* transfers the current value to the Sig Gen menu as the keyed in value.

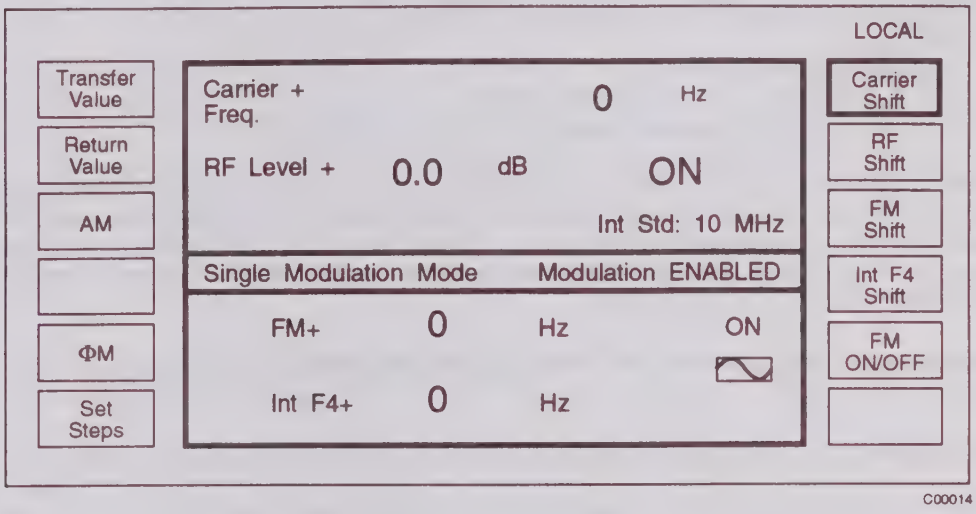

Fig. 3-1-18 Total shift menu

Setting increment values

(1) From the total shift menu select *[Set Steps]*. The screen shows the currently set step sizes.

(2) Select *[Carrier Step]*, enter the value on the key pad and press a terminator key. The step value will appear on the screen.

(3) Return to the main menu by pressing [SIG GEN].

(4) Using the ⇑/⇓ keys respectively will now increment or decrement the carrier frequency by the set value.

(5) *[RF Level Step]*, *[AM step]* and *[Source Step]* values can be entered in the same way.

Note...

Wideband FM and Pulse modulation parameters cannot be incremented in this manner.

SWEEP

The sweep capability allows the comprehensive testing of systems, as measurements at single points will not necessarily give an overall indication of the performance. The sweep function is specified by the following parameters:

- Start value
- Stop value
- Number of steps
- Time per step

Up to five individually adjustable markers may be set. Each marker can be turned on and off separately. Sweep functions available are:

- Carrier frequency with or without modulation
- RF Level
- Internal modulation rate
- LF frequency (if in LF generator mode)
- LF level (if in LF generator mode.

The sweep can be operated in single shot or continuous modes with the start command triggered by a key press, an external pulse or GPIB control. Once started, the sweep can be stopped at any time when the display will indicate the current parameter value. The sweep can be used with oscilloscopes, X-Y display units and X-Y plotters by connecting the display unit X input to the SWEEP RAMP output on the rear panel.

A sweep routine is set up as described in the following paragraphs:

Sweep type

(1) Press the [SWEEP] hard key. The sweep parameters display, with soft key options, appears on the screen, see Fig. 3-1-19.

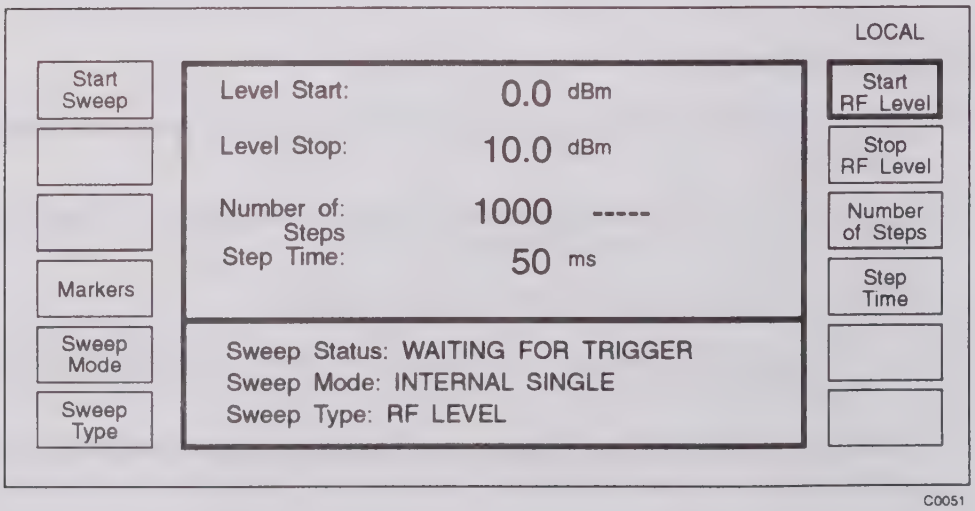

Fig. 3-1-19 Sweep parameters display

(2) Press *[Sweep Type]*. The *Sweep Type Menu* is displayed, see Fig. 3-1-20.

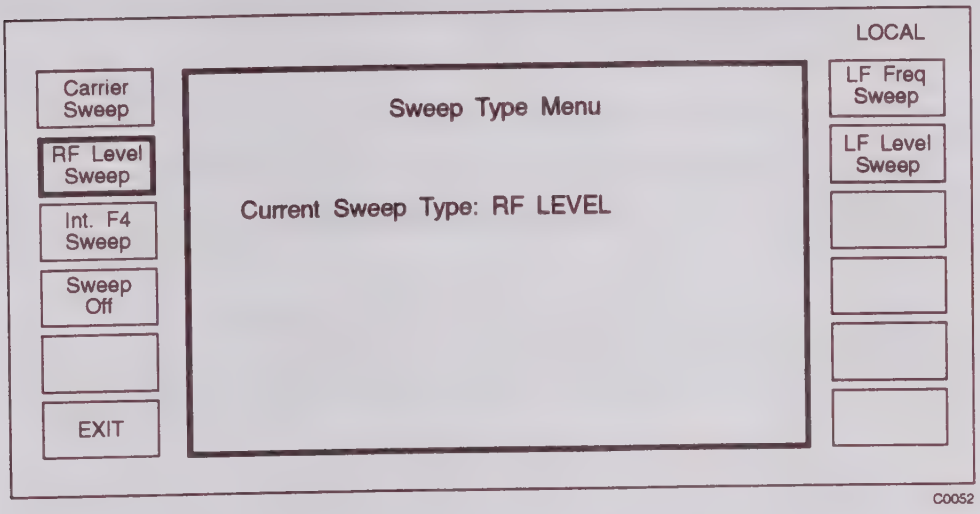

Fig. 3-1-20 Sweep type menu

The instrument must be in the LF generator mode before an LF frequency sweep and LF level sweep can be initiated.

Modulation required during sweep should be entered before putting the instrument in the sweep mode.

(3) Select the required sweep type by pressing the appropriate soft key, e.g. *[Carrier Sweep]*. The Sweep Type screen changes to confirm the selection.

(4) Press [*EXIT*] or [SWEEP] to return to the sweep parameters display.

Sweep mode

(1) At the sweep parameters menu, press *[Sweep Mode]*. The *Sweep Trigger Mode Menu* is displayed, see Fig. 3-1-21.

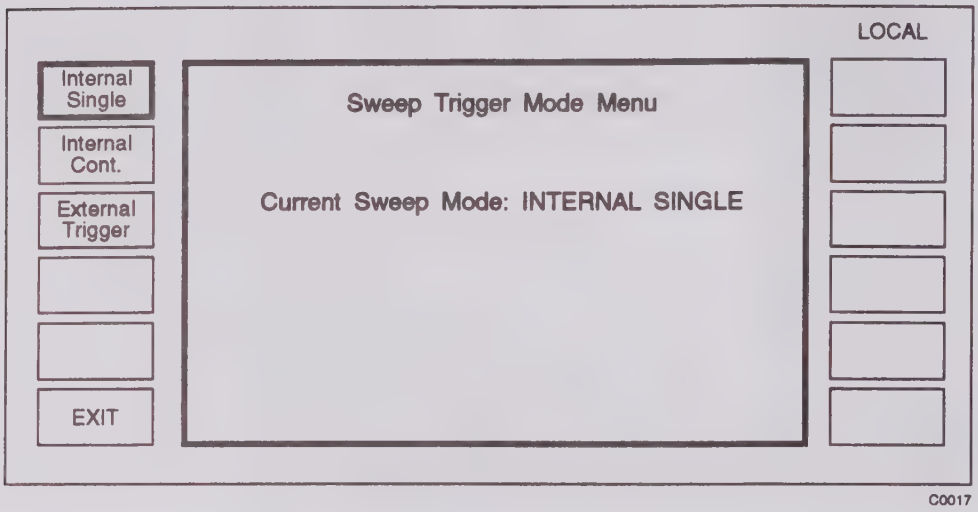

Fig. 3-1-21 Sweep trigger mode menu

(2) Select the sweep mode, *[Internal Single]*, *[Internal Cont.]*, or *[External Trigger]*.

(3) Press *[EXIT]* to return to the sweep parameters display menu.

(4) If *[External trigger]* is selected, press [UTIL], select *[Utils. Menu 1]* and from this menu press *[External Trigger]*. The *External Trigger Selection Menu* will be displayed. Then press [SWEEP] to return to the Sweep Parameters display.

Start value

(1) Select the appropriate soft key to enter the start value, e.g. *[Start Freq]*.

(2) Enter the required start value via the numerical key pad and the appropriate terminator key.

Stop value

(1) Select the appropriate soft key to enter the stop value, e.g. *[Stop Freq]*.

(2) Enter the required stop value via the numerical key pad and the appropriate terminator key.

When carrier frequency parameters are entered, the instrument calculates all the individual step values together with any level and modulation correction factors. While this process is taking place, the sweep status line changes to indicate '*CALCULATING SWEEP*'.

Number of steps

(1) Select *[Number of Steps]*.

(2) Enter the number of steps via the numerical key pad and the [GHz/V/enter] terminator key.

Note...

If an inappropriate number of steps is selected, the instrument will automatically choose a more reasonable value. The number of steps available depends on the operating mode and the maximum values are:

250	for carrier frequency with FM, ΦM or Wideband FM enabled
1,000	for carrier frequency without FM, ΦM or Wideband FM enabled.
10,000	for RF level, RF modulation frequency, LF frequency and LF level.

Step time

(1) Select *[Step Time]*.

(2) Enter the step time via the numerical key pad and the [MHz/mV/ms] terminator key.

Markers

A facility exists for producing markers, controlled by the Markers Menu, see Fig. 3-1-22.

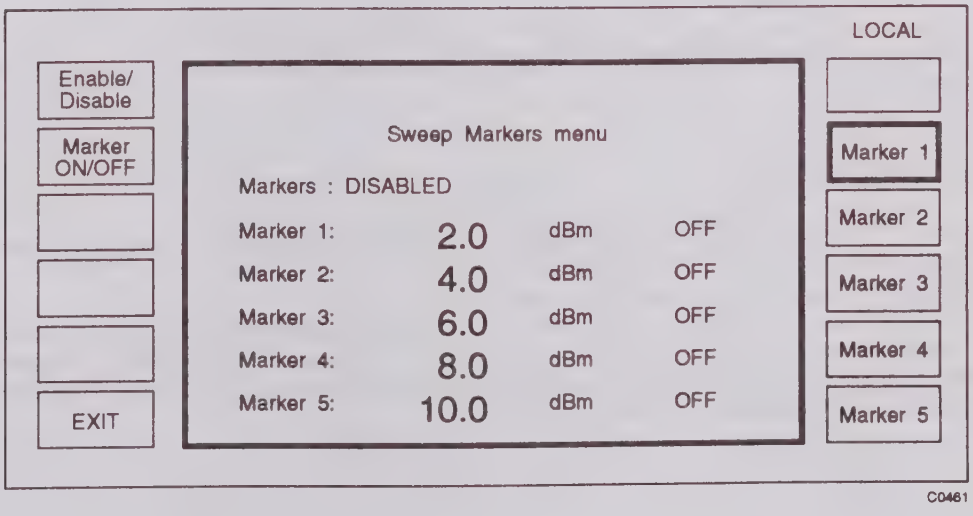

Fig. 3-1-22 Markers menu

To set a marker, press one of the marker soft keys e.g. *[Marker 3]*, enter the required value on the key pad and terminate with the appropriate units hard key. Turn the marker ON using the *[Marker ON/OFF]* key. When all markers have been entered use the *[Enable/Disable]* key to activate the marker output on the rear panel. The marker output produces a positive going pulse with a duration of one sweep step when the sweep passes a marker value.

Starting the sweep

From the sweep parameters menu, press *[Start Sweep]*. The single sweep status line display changes from *WAITING FOR TRIGGER* to *SWEEPING* and a solid bar increments to show the sweep progression, see Fig. 3-1-23.

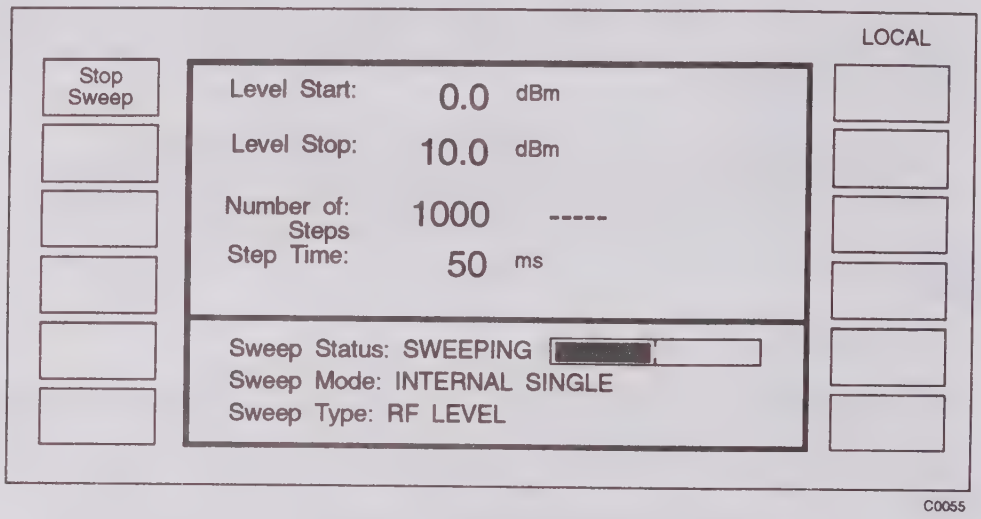

Fig. 3-1-23 Sweep in progress

Note ...

When the sweep is in progress, all the hard keys are disabled and *[Stop Sweep]* is the only active soft key.

Stopping the sweep

Press *[Stop Sweep]*. The sweep stops and the menu presents the opportunity to press:-
[Reset Sweep] to change the sweep parameters, or
[Continue Sweep] to continue the sweep, or
[Transfer] to transfer the current value of the swept parameter as the last keyed in value in the [SIG GEN] or [LF](*[LF Gen]*) mode, see Figs. 3-1-24 and 3-1-25. When the sweep is in the paused state, the ⇑ and ⇓ keys can be used to step the parameter up or down. The sweep can then be continued by pressing *[Continue Sweep]*.

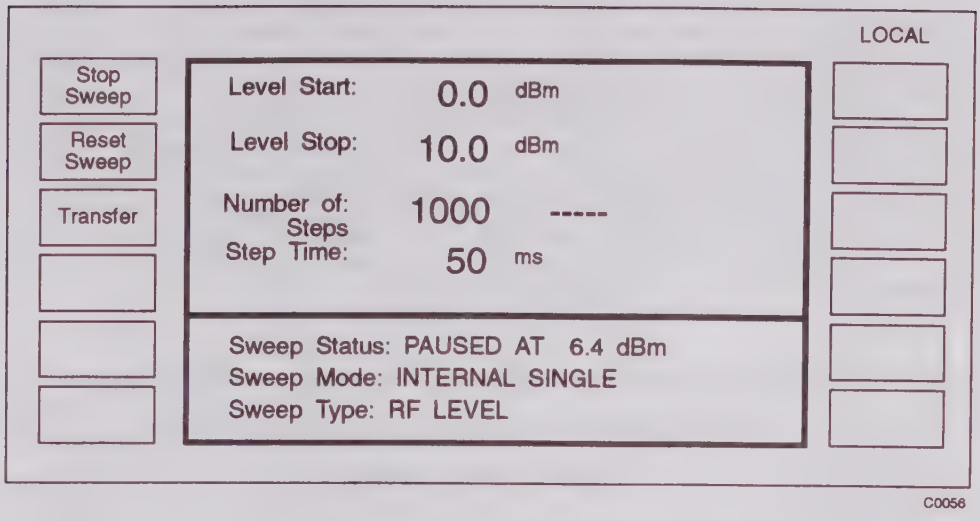

Fig. 3-1-24 Sweep stopped

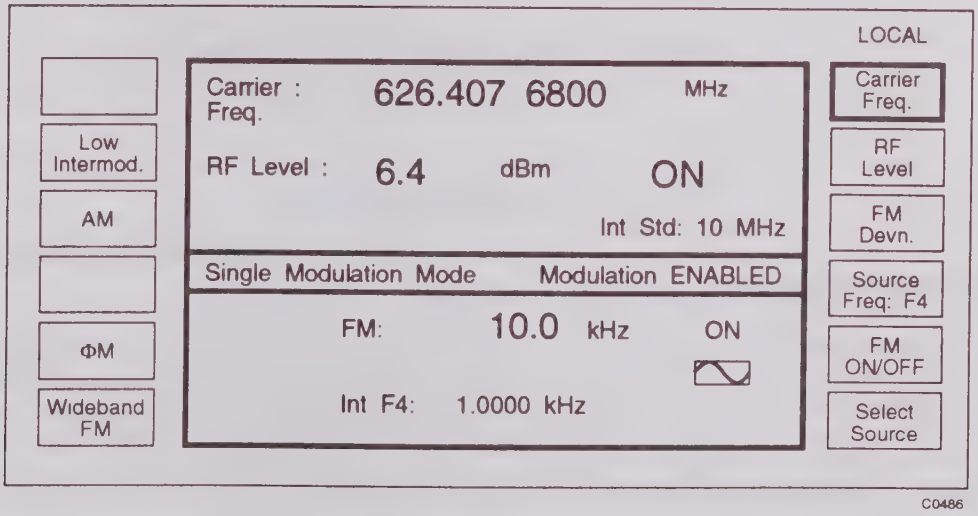

Fig. 3-1-25 RF level transferred

UTILITIES

The utilities options are accessible from two primary menus, *Utilities Selection Menu 1* and *Utilities Selection Menu 2*. When a selection is made from either of these menus and **[UTIL]** is subsequently pressed, the primary menu is re-displayed. However, if instead a selection is made and then one of the other hard keys e.g. **[SWEEP]** is pressed, pressing **[UTIL]** subsequently once returns to the sub-menu, pressing it again returns to the primary menu. This provides an operating short-cut in that it allows a sub-menu to be re-accessed without first having to go again through the primary menu. This scheme does not apply to the *[TIME & DATE]* soft key or to the **[Sig Gen]** hard key. The display for *Utilities Selection Menu 1* is shown in Fig. 3-1-26. To obtain *Utilities Selection Menu 2* from the menu, press *[Utils. Menu 2]*.

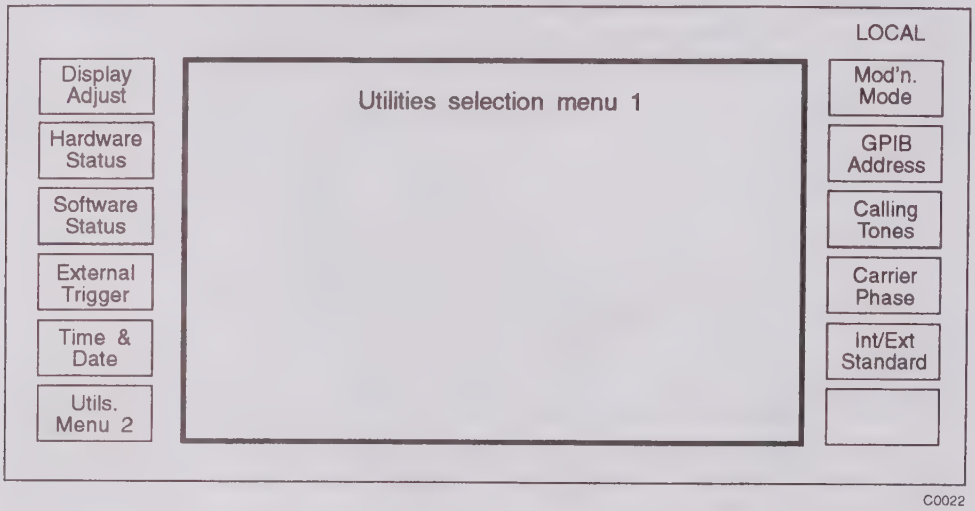

Fig. 3-1-26 Utilities selection menu 1

Adjusting the display

To adjust the display, press *[Display Adjust]*. The *Display Adjust* menu is displayed on the screen, see Fig. 3-1-27. The backlight, which is on when the instrument is switched ON, can be toggled ON or OFF using the *[Display On/Off]* key, and when ON can be varied in brightness by *[Dim]*, *[Medium 1]*, *[Medium 2]* and *[Bright]*. Contrast is adjusted with the control knob. Once adjusted, the LCD setting can be stored in the the non-volatile memory by pressing *[Save LCD Setting]*. The instrument always activates the backlighting whenever it is switched on.

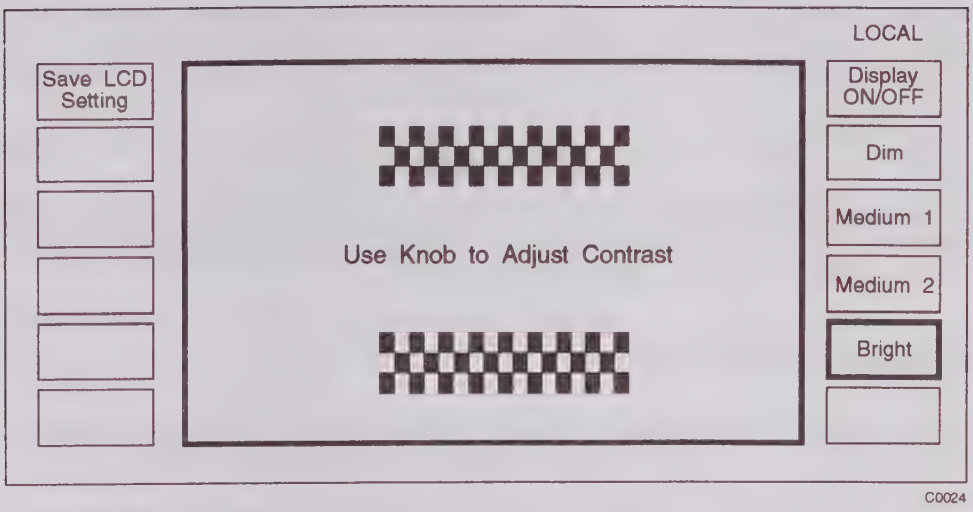

Fig. 3-1-27 Display adjust menu

Hardware information

To obtain a description of the instrument hardware, press *[Hardware Status]* and the following information is displayed:

Instrument type (e.g. *2031*)
Serial no. (e.g. *1543256/045*)
Options fitted (e.g. *SECOND LF OSC.*)
Attenuator type and serial number.

For attenuator calibration information, refer to the Service Manual.

Software information

To obtain a description of the instrument software, press *[Software Status]* and the following information is displayed:

Software Version Number e.g. *2.001*
Part number e.g. *44533-366*
GPIB address e.g. *07*

External trigger

The external trigger facility allows the rear panel TRIGGER input to be set up so as to initiate a defined change in the generator setting. To define the function press *[External Trigger]*. The display changes to show the *External Trigger Selection Menu* which has the following options:

[Sweep Start]	Starts the external sweep.
[Sweep Step]	Goes to next step of external sweep.
[Send Seq Tones]	Equivalent to *[Send Tones]* on main menu.
[Recall Up]	Recall next store.
[Recall Down]	Recall previous store.
[No Ext. Trigger]	Trigger ignored (default)

The external TRIGGER input requires a TTL type input and includes an internal pull-up resistor to +5 V. A switch closure to ground or an applied voltage transition from +5 V to 0 V on the rear panel socket initiates the defined trigger action.

Setting the modulation mode

Modulation mode selection allows the generator to be configured to provide carriers modulated by one, two or four (2 internal and 2 external) modulation sources.

Press *[Mod'n Mode]* to display the *Modulation Mode Selection Menu*, choose the type of modulation required by pressing *[Single]*, *[Dual]*, *[Comp]* or *[Dual Comp]*, see 'Modulation mode selection' above.

Setting the GPIB address

Press *[GPIB Address]* to display the *GPIB Address Change Menu*. To change the address, enter the address, in the range 0-30, via the numerical key pad and press [enter]. The data is then saved automatically in the non-volatile memory. For information on operating the instrument via the GPIB, refer to Chapter 3-2.

Sequential calling tones

Sequential calling tones are set up from a utility menu, Fig. 3-1-26, and are activated by pressing *[Send Tones]* which appears on the main menu after the tones have been set up. *[Send Tones]* also appears on the calling tones menu. Pressing the *[Calling Tones]* soft key at *Utilities Selection Menu 1* calls up the *Sequential Calling Tones Utility* menu, see 'SIGNALLING'.

Carrier phase adjustment

Pressing *[Carrier Phase]* displays the *Carrier Phase Control Menu*. To advance or retard the carrier phase (with respect to its current phase) in steps of $\pi/128$ radians, approximately 1.4°, rotate the control knob clockwise to advance the phase and counter-clockwise to retard the phase.

Selection of frequency standard

Pressing *[Int/Ext Standard]* changes the menu to display the *Frequency Standard Selection Menu* which has the following options:

1 MHz Int. Std.
5 MHz Int. Std.
10 MHz Int. Std.
1 MHz Ext. Std.
5 MHz Ext. Std.
10 MHz Ext. Std.

If the internal standard is selected, it is available as an output at the selected frequency on the rear panel. Selecting an external option enables the instrument to accept a standard from an external source at that frequency. These settings are saved in the non-volatile memory.

Selection menu 2

Press *[Utils Menu 2]* from *Utilities Selection Menu 1*. The display now changes to show *Utilities Selection Menu 2*, see Fig. 3-1-28. This menu allows access to the protected data. Utilities on this menu have either 1st or 2nd level protection.

If the instrument is locked, the appropriate level must be unlocked otherwise the utility will only be usable in a read only mode. To change parameters, the function must be unlocked. The procedure is:

[UTIL] ⇒ *[Utils. Menu 2]* ⇒ *[Lock & Unlock]* ⇒ *Function Unlocking Utility* menu ⇒ *[Unlock Level 1]* or, for servicing, *[Unlock Level 2]*.

The correct password must be entered. Many of these activities are intended for use in servicing and are described in the Service Manual.

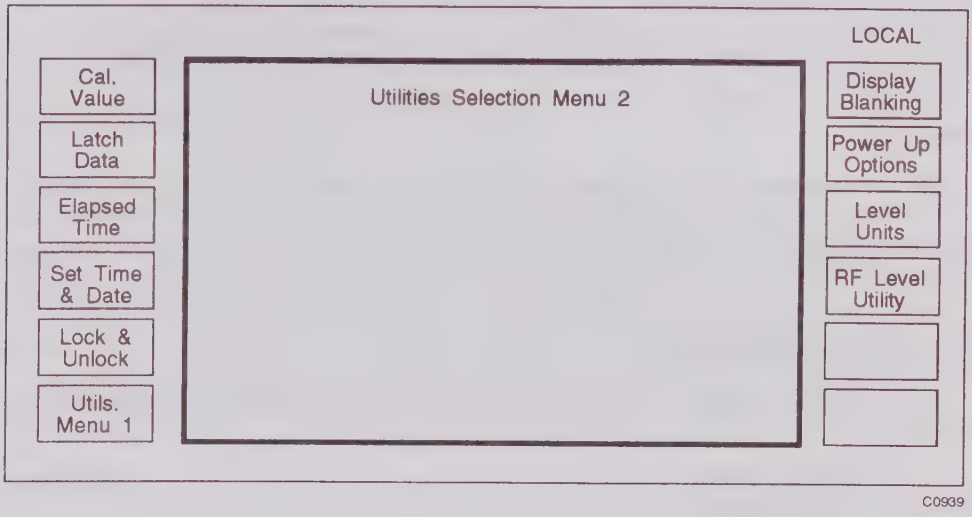

Fig. 3-1-28 Utilities selection menu 2

Calibration

Pressing *[Cal. Value]* brings the *Calibration Utilities Menu* to the display, see Fig. 3-1-29. This menu shows when the last complete check was made and when the next calibration check is due. It also shows the date on which the individual items were adjusted. It is possible to inspect the calibration value of these items but calibration cannot be carried out unless the protection facility is unlocked at Level 2. Full details regarding calibration can be found in the Service Manual.

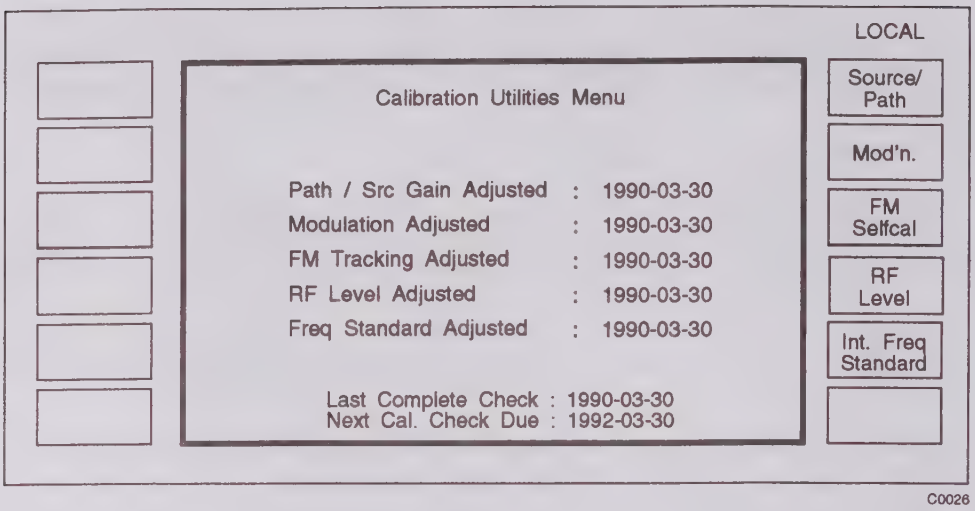

Fig. 3-1-29 Calibration utilities menu

Latch data

The latch data menu is intended for use as a diagnostic aid by allowing data to be sent to latches within the instrument. For further information consult the Service Manual.

Elapsed time

The elapsed time facility displays the number of operating hours since the function was last reset. Pressing *[Elapsed Time]* displays the number of operating hours and the date on which the function was last set to zero. This facility can be used to assess the instrument's operational reliability and utilisation.

Locking and unlocking

Press *[Lock & Unlock]*. When Level 1 and Level 2 are both locked, the menu displays three soft keys:

Unlock Level 1
Unlock Level 2
Serial No. Set

Press *[Unlock Level 1]* and the message *Enter 4 Digit Password*: will appear on the display. Level 1 is unlocked by entering the 4 digits on the key pad and pressing [enter]. The menu will change and two soft keys, *[Lock level 1]* and *[Lock Keyboard]*, will appear on the left-hand side. The default password is 1234. If this password is not recognised by the instrument, the password has been changed by your calibration/repair department personnel who should be consulted for further information. *[Unlock Level 2]* is only used during servicing. Refer to the Service Manual for details.

Setting time and date

Unlock to Level 1 (see 'Selection menu 2' and 'Locking and unlocking' above). Set the time and date by pressing *[Set Time & Date]* at *Utilities Selection Menu 2*. The screen shows the current time, date and day of the week. The time shown does not change during display. The clock is powered by a rear panel battery, see Chap. 2, 'BATTERY REPLACEMENT'.

[Set Time] Press this key to set the time. Using the key pad enter the hour and minutes (24 hour clock). Separate the hour and minutes fields by a hyphen, e.g. 21-30. Terminate the entry by [enter] which starts the clock.

[Set Date] Press this key to set the date (in ISO format). Using the keypad enter the year, month and day. Separate the year, month and day fields by a hyphen e.g. 1992-04-23. Terminate the entry by [enter]. The day of the week is automatically determined when the date is set.

Keyboard locking

Unlock to Level 1, see 'Selection Menu 2' and 'Locking and Unlocking' above. Keyboard operation is disabled by pressing *[Lock Keyboard]*. The instrument automatically returns to the main menu which indicates the locked status by displaying a key-shaped icon in the top left-hand corner of the display. The keyboard can be re-enabled by entering the 4 digit password for Level 1 using the key pad and pressing [enter]. The keyboard status is saved in the non-volatile memory.

Display blanking

To prevent sensitive data from being displayed, the 2030 Series Signal Generators include a display blanking facility. This allows various parts of the display to be replaced by a series of dashes so that values entered by the user or recalled from the memory will not be visible. The instrument must be unlocked to Level 2 to enable or disable this facility. Consult the Service Manual for further information.

Power up options

Unlock to Level 1, see 'Selection Menu 2' and 'Locking and Unlocking' above. Two options are available by pressing *[Power Up Options]* at *Utilities Selection Menu* 2. These options are *[Factory]* and *[Memory]*. When *[Factory]* is pressed, the factory set power up state is recalled. Pressing *[Memory]* causes *[Memory Number]* to appear at the right-hand side of the menu. To change the power up state of the instrument to a particular setting, enter the memory number of the full store on the key pad and press [enter].

RF level units

RF output level units can be altered using the *[Level Units]* key. The level units may be entered as an EMF or PD, and the logarithmic units can be referred to volts (dBV), millivolts (dBmV), microvolts (dBμV) or to 1 milliwatt into 50 Ω(dBm). Select the units by pressing *[Level Units]* which displays the *RF Level Units Selection Menu* shown in Fig. 3-1-30.

To change the default RF level units shown at switch on, first unlock the instrument to Level 1. This causes an additional soft key to be displayed in the top left box (see Fig. 3-1-30). Select the required RF level units and press the additional *[Save RF Units]* key to save these as the default units.

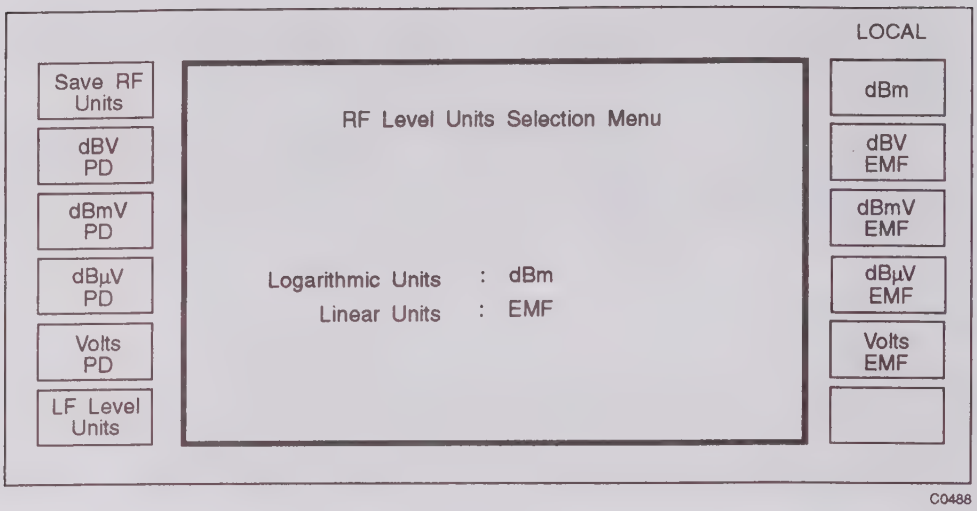

Fig. 3-1-30 RF level units selection menu (shown unlocked to level 1)

LF level units

LF level logarithmic units may be referenced to 1 volt EMF (dBV EMF), 1 millivolt EMF (dBmV EMF) or 1 milliwatt into 600 Ω(dBm). Linear units are always set EMF values.

Select the units by pressing the *[LF Level Units]* soft key on the *RF Level Units Selection Menu* which calls up the *LF Level Units Selection Menu* shown in Fig. 3-1-31.

To change the default LF level units shown at switch on, first unlock the instrument to Level 1. This causes an additional soft key to be displayed in the top left box (see Fig. 3-1-31). Select the required LF level units and press the additional *[Save LF Units]* key to save these as the default units.

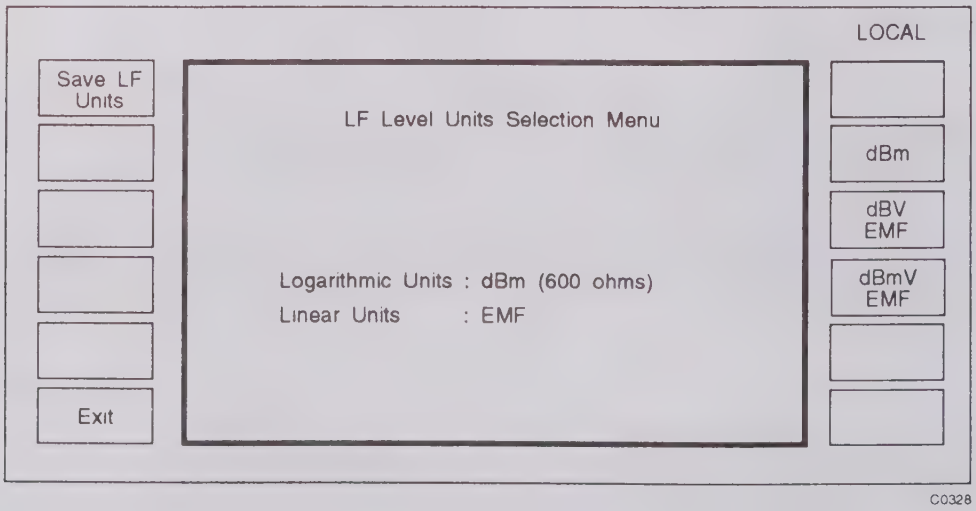

Fig. 3-1-31 LF level units selection menu (shown unlocked to level 1)

RF level utility

Selecting *[RF Level Utility]* from the *Utilities Selection Menu 2* displays the *RF Level Utility Menu* shown in Fig. 3-1-32.

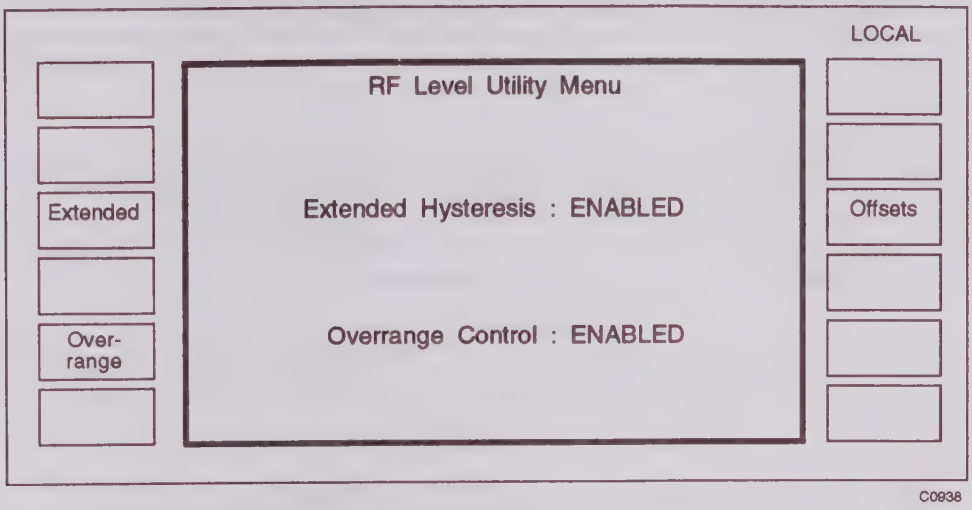

Fig. 3-1-32 RF level utility menu

Extended hysteresis

Pressing the *[Extended]* soft key toggles the status (Enable/Disable) of extended hysteresis. When enabled, this provides an electronic level function which uses the internal D/A converter, rather than the attenuators, to provide an uninterrupted (glitch-free) level control. This increases the electronic level control from ±7 dB to +12 to -18 dB. A *+HYST* or *-HYST* message is displayed on the *Sig Gen* menu to indicate when in hysteris and in which direction.

During normal operation the RF output is controlled as shown in Fig. 3-1-33 by electronically controlling the output level over a limited range (normally approximately 0 to +6 dBm) and switching in 6 dB attenuator pads to provide lower RF levels.

When the hysteresis function is enabled and a keyboard entry of the RF level is made, the signal generator sets the level in the normal way. However, when the rotary control is enabled and used to adjust the RF level, the normal attenuator changes are suppressed. When the level is increased, the attenuator change is suppressed for 6 dB above the normal range and *+HYST* is displayed. Similarly, when the level is reduced attenuator changes are suppressed for 12 dB below the normal range and -HYST is displayed. When the extended hysteresis range is exceeded the attenuator and the electronic control are reset to values corresponding to the normal operation of the generator. An example of extended hysteresis operation is shown in Fig. 3-1-34.

With the rotary control in use in the hysteresis range of operation, the generator can be instructed to set the RF level to the same value, but set using the [V], [mV], [µV] or [dB] keys. This is a useful facility if the user is investigating squelch systems and wants to ensure that varying the level around the current value will not result in an attenuator change.

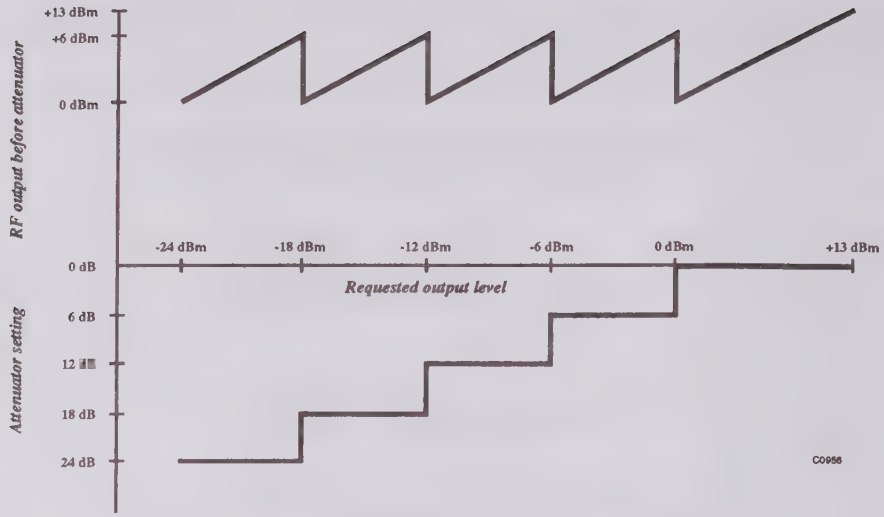

Fig. 3-1-33 Normal signal generator level control operation

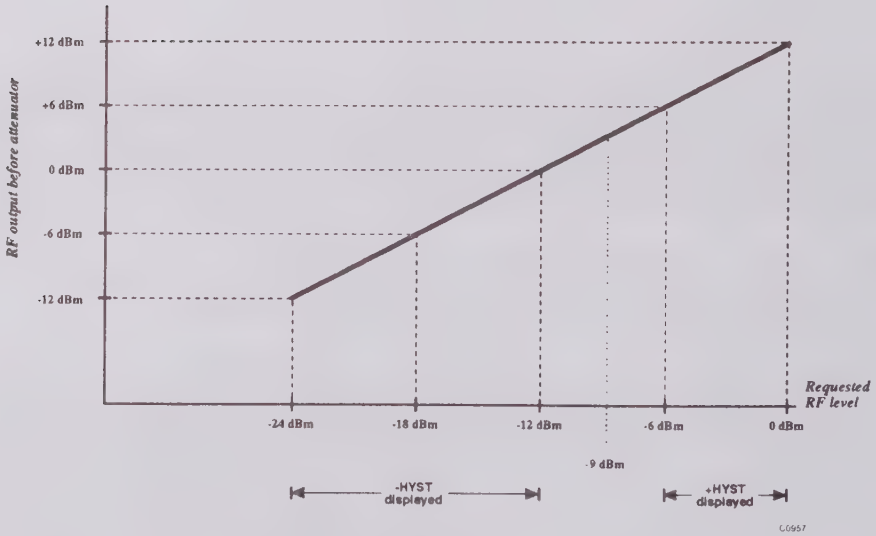

Fig. 3-1-34 Extended hysteresis operation with an RF level of -9 dBm as the starting level

Note...

In the hysteresis range the RF level is set in a different way to the normal operation and this will affect some performance aspects. AM distortion and accuracy will be affected. With no AM selected, the effect on RF accuracy in the +HYST region will be relatively minor. But the effect in the -HYST region on RF level accuracy will be more significant.

Overrange

Pressing the *[Over-range]* soft key toggles the status (Enable/Disable) of the overrange control. When enabled, the maximum RF output power is extended by an additional 6 dB (subject to instrument capability). This increases the maximum output power from +13 to +19 dBm for the standard instrument and from +19 to +25 dBm for an instrument fitted with Option 003. If the requested output level is in the overrange region the *UNCAL* message is displayed on the *Sig Gen* menu.

Note...

If the overrange facility is enabled the signal generator is capable of generating much higher signal levels. If the generator is set to a frequency below 21.09375 MHz and the RF output is not terminated in 50 Ω then the RPP may be tripped by the internal RF signal. If this happens the RPP can only be rest if a 50 Ω termination is connected to the RF OUTPUT socket.

RF offset

With the instrument unlocked to Level 1, see 'Locking and unlocking' above, pressing *[Offsets]* produces the layout for the soft keys shown in Fig. 3-1-35.

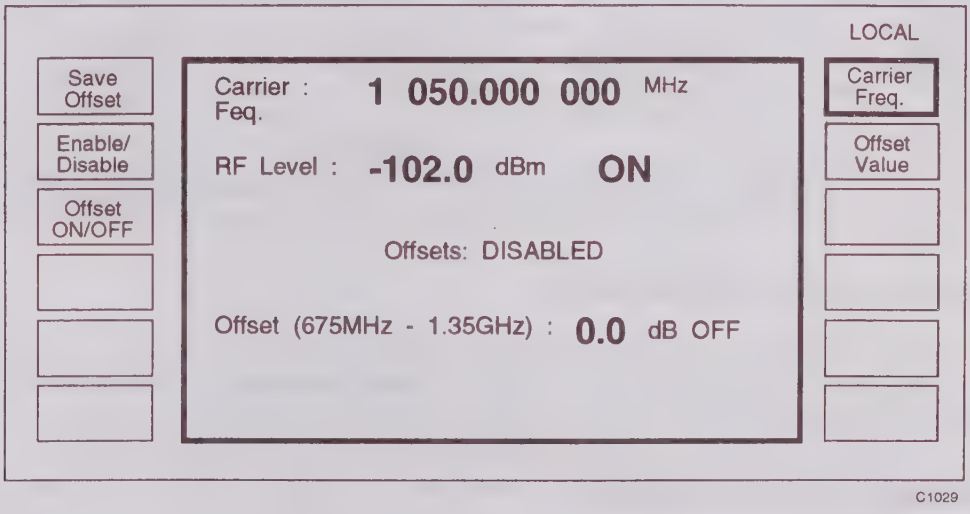

Fig. 3-1-35 RF offset adjustment menu

To compensate for cable or switching losses or to standardize a group of instruments so that they give identical measurements, the RF output level can be offset by up to ±2 dB. This is done by selecting *[Offset Value]* and either keying in the value or making the adjustment with the control knob. A separate offset can be set for the carrier frequency range 10 kHz to 337.5 MHz and each octave above this. Offsets can be turned on or off individually using the *[Offset ON/OFF]* key or all offsets can be turned on or off via the *[Enable/Disable]* key.

Note...

This facility is replaced by a more versatile system on generators supplied with Option 008, RF profiles and complex sweep. The facility is described in Chap. 1 under 'Options'.

LOW FREQUENCY OPERATION

The instrument has two modes of LF operation. The LF output can be used either as a modulation signal monitor or as an independent low frequency generator. Pressing [LF] displays either the *LF Monitor Menu* or the *LF Generator Menu*, depending on which mode was last selected.

LF monitor

The left-hand side of the LF Monitor Menu, varies according to the modulation mode; single, composite, dual or dual composite. In each case the right hand side is occupied by a single soft key, *[LF Gen.]*.

TABLE 3-1-1
LIST OF AVAILABLE SOFT KEYS FOR DIFFERENT MODULATION MODES

Single	Composite	Dual	Dual Composite
Mod. Drive	Mod. Drive	AM Drive	AM Drive
Mod. Source	Mod. 1 Source	AM Source	AM 1 Source
-	Mod. 2 Source	-	AM 2 Source
-	-	FM/ΦM Drive	FM/ΦM Drive
-	-	FM/ΦM Source	FM/ΦM 1 Source
-	-		FM/ΦM 2 Source

Modulation source monitoring

Internal sources only may be monitored. To monitor a modulating signal source, press the appropriate key. The source monitor level and the source information appear on the display. The modulating signal output is fed to the LF OUTPUT socket at a fixed level of 1 V.

Modulation drive monitoring

Modulation drive monitoring is intended for the user to monitor complex modulating signals from both internal and external sources. To monitor a modulation drive, press the appropriate key. The LF Monitor Level and the selected drive are displayed.

When the summed AM drive signal is selected, a signal which is the sum of both AM channels is fed to the LF OUTPUT socket, if in a composite or dual composite mode. The LF level function controls the output level at 100% depth, therefore the actual output voltage depends on the modulation depth. If AM is turned off, the associated LF output is removed.

The summed FM/ΦM drive signal is also fed to the LF OUTPUT socket. The signal is the sum of both FM/ΦM channels. The FM drive signal at the monitored point is nominally 1 V but varies over a range of approximately 3 dB (except at deviation values below about 1 kHz) depending on the set modulation and the carrier frequency selected. If FM/ΦM is turned off, the LF signal is removed. If one component of a composite modulation setting is turned off, the component which is left on remains at its original level.

Note...

Wideband FM and pulse modulating signals are not accessible via the monitor mode.

Use as an independent LF generator

To use the instrument as an independent LF generator, select *[LF Gen.]* at the *LF Monitor Menu*. The *LF Generator Menu* appears on the display as shown in Fig. 3-1-36.

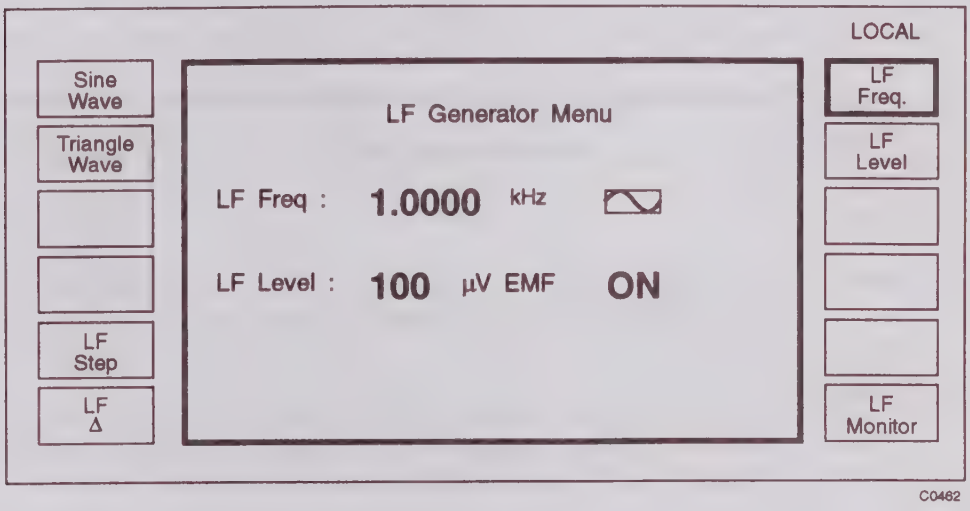

Fig. 3-1-36 LF generator menu

In this mode, one internal oscillator must be used exclusively for this task. Consequently if only one oscillator is fitted, no internal modulation is available to the signal generator while the LF generator is in use. If a second oscillator is fitted, only one is available to the signal generator.

LF frequency and LF level are adjusted by pressing the appropriate key and entering the value via the numerical keypad and pressing [enter]. To set step values, press *[LF Step]* for the *LF Step Menu*. *[Freq. Step]* or *[Level Step]* can be selected and the values entered as before. To display the *LF Total Shift Menu*, press *[LF Δ]*.

To regain the oscillator as a modulation source, select the monitor mode.

Note...

The LF output is entered as V/mV/µV or dBm/dBV/dBmV representing the open circuit voltage fed to a high impedance, but the steps are entered in dB and the control knob has a fixed resolution of 0.1 dB.

MEMORY

Memory recall

Pressing the **[MEM]** hard key after switch on, causes the *Memory Recall Menu*, Fig. 3-1-37, to be displayed. There are four types of recall, full, partial, carrier frequency and sweep. Provision is made for an option not to recall the carrier frequency for full and partial stores. This allows one carrier frequency to be used with a series of stored settings. Pressing *[Inhibit ON/OFF]* turns the option ON and OFF. The state of the option is indicated on the display.

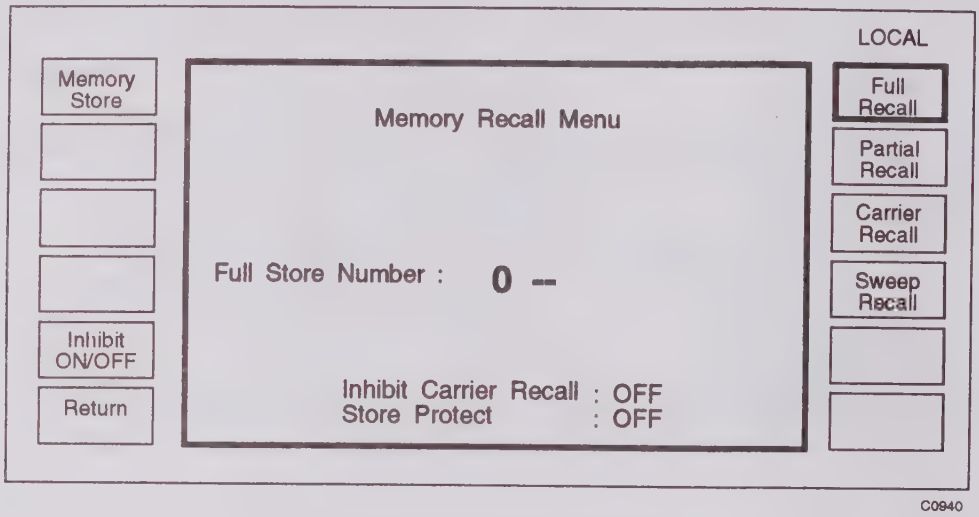

Fig. 3-1-37 Memory recall menu

Full recall

Selecting *[Full Recall]* enables the recall of a complete instrument setting, i.e. carrier frequency, RF level, modulations and their increments, ON/OFF and source information. Also recalled are all 6 modulation oscillator frequencies, plus one increment, and the LF Generator/Monitor setting. *[Inhibit ON/OFF]* provides the option not to recall the carrier frequency setting. The state of the option is indicated on the display. There are 50 locations (numbered 0 to 49) for full recall. A further location (50) allows the factory default settings to be recalled. The factory default settings are listed in Table 3-2-1.

Partial recall

This is a less comprehensive recall of only those parameters which currently affect the RF output; carrier frequency, RF level, modulations in use (without increments), ON/OFF and source information and the two modulation oscillator frequencies in use. As with full store, the option not to recall the carrier frequency is provided. There are 50 locations (numbered 0 to 49) for partial storage.

Carrier recall

The carrier frequency store has 100 locations (numbered 0 to 99) which may be recalled when required.

Sweep recall

The sweep store has 20 locations (numbered 0 to 19) containing complete sets of sweep parameters which may be recalled when required.

Note...

Sweep parameters can be recalled whether the instrument is in sweep mode or not. They are only used when sweep is selected.

Recalling data

To recall data, press the soft key for the type of recall required, e.g. *[Carrier Recall]* and select the location by means of the key pad. The ⇑ and ⇓ keys can be used to recall the next locations. Pressing *[Return]* recalls the location last specified on the numerical key pad.

Stores can be incremented or decremented externally by means of the SWEEP TRIGGER socket (see 'External trigger' above).

Note...

The settings for the sequential calling tones are recalled via the call ng tones menu in UTILITIES, see Fig. 3-1-26. These stores can be erased from the *Store Erase Menu.*

Inhibit ON/OFF

When recalling full or partial stores it is sometimes useful for the existing carrier frequency setting to remain and not be replaced by the stored setting. The Inhibit Carrier Recall facility offers this capability. To prevent the current carrier frequency from being replaced use the *[Inhibit ON/OFF]* key to set the *Inhibit Carrier Recall* annunciator to *ON*.

To allow the carrier frequency setting to be overwritten use the *[Inhibit ON/OFF]* key to set the *Inhibit Carrier Recall* annunciator to *OFF*.

Memory stepping facility

The **[Sig Gen]** key has a toggle action in that pressing the key a second time displays the *Memory Stepping* menu shown in Fig. 3-1-38. This facility enables the memory to be stepped up and down from a start location (selected using the *Memory Recall Menu*), whilst displaying the settings for that memory.

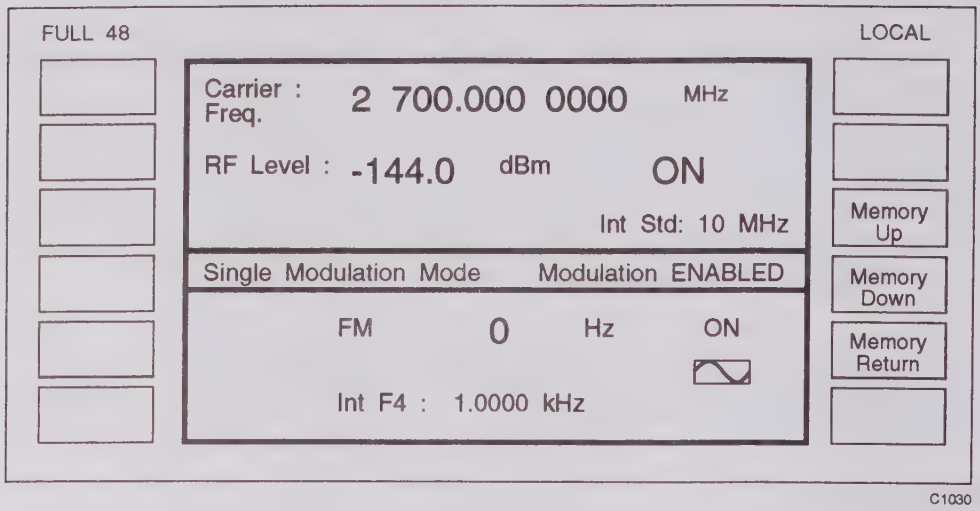

Fig. 3-1-38 Memory stepping menu

Pressing *[Memory Up]* or *[Memory Down]* respectively increments or decrements the memory location. With each step the settings stored in the location are displayed together with, at the top left of screen, the memory type and location e.g. *Full 48*. Incrementing and decrementing can also be done externally by means of the SWEEP TRIGGER socket (see 'External trigger' above). Pressing *[Memory Return]* at any time returns to the start location.

When a limit is reached, e.g. for Full Recall locations 0 and 49, a further step will reset to the start location. But note that if the start location coincides with a limit, trying to step past that limit will cause the limit and start locations (in this case the same numbered locations) to be alternately displayed. To make the user aware of this situation, the message *At Top Limit* or *At Bottom Limit* is displayed at the top centre of screen.

Memory store

Pressing the *[Memory Store]* soft key causes the *Memory Store Menu*, Fig. 3-1-39, to be displayed. There are four types of store, full, partial, carrier frequency and sweep.

To prevent the accidental overwriting of memory contents, a store protection facility is provided. If this feature is enabled, the screen legend will indicate *Store Protect: ON* and the store key legends at the right of the screen will not appear.

Note...

Sequential calling tone sequences can be stored from the *Sequential Calling Tones Utility* menu. There is provision for storing up to 20 tone sequences.

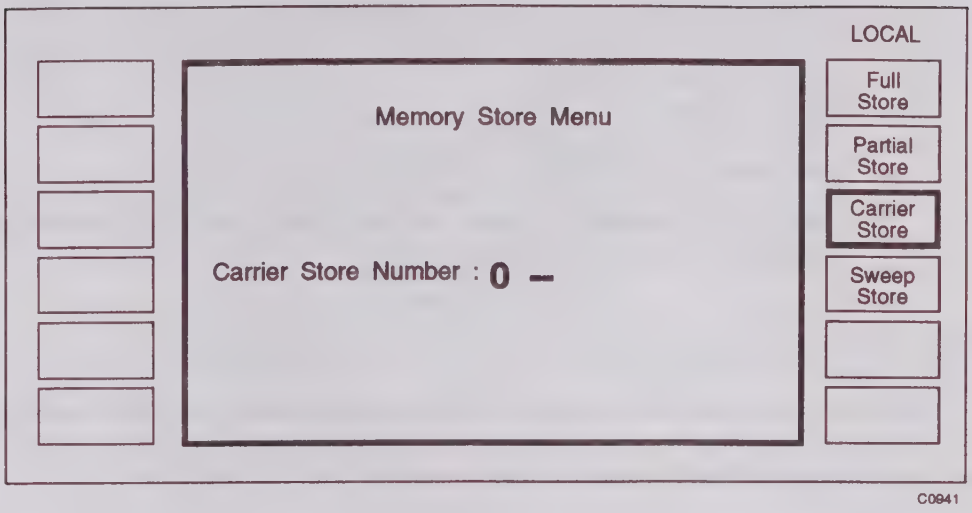

Fig. 3-1-39 Memory store menu

Full store

Selecting *[Full Store]* enables the storage of a complete instrument setting, i.e. carrier frequency, RF level, modulations and their increments, ON/OFF and source information. Also stored are all 6 modulation oscillator frequencies, plus one increment, and the LF Generator Monitor setting. There are 50 locations (numbered 0 to 49) for full storage. A further location (50) holds the factory default settings. This memory cannot be written to by the user. The factory default settings are listed in Table 3-2-1.

A Full Store contains the following information:

Carrier frequency setting
Carrier frequency step size
RF level setting
RF level step size
All modulation settings
All modulation step sizes
Modulation mode and status
All six internal oscillator frequency settings
The modulation frequency step size
LF generator frequency setting
LF generator frequency step size
LF generator level setting
LF generator level step size
LF monitor settings
Display blanking settings

Partial store

This is a less comprehensive store of only those parameters which currently affect the RF output; carrier frequency, RF level, modulations in use (without increments), ON/OFF and source information and the two modulation oscillator frequencies in use. There are 50 locations (numbered 0 to 49) for partial storage.

A Partial Store contains the following information:

Carrier frequency setting
RF level setting
The active modulation settings
Modulation mode and status
The frequency of the active modulation frequencies
Either the LF generator frequency and level setting or the LF monitor setting (depending on which mode is selected)

Carrier store

The carrier frequency store has 100 locations (numbered 0 to 99) for the storage of carrier frequency only. This store can be used in conjunction with the full and partial stores to apply a set of test conditions to a range of frequencies.

Sweep store

The sweep store has 20 locations (numbered 0 to 19) for the storage of complete sets of sweep parameters.

Note...

Sweep parameters can be stored whether the instrument is in sweep mode or not. They are only used when sweep is selected.

Storing data

To store data, press the soft key for the type of store required, e.g. *[Partial Store]* and define a store location via the numerical key pad, then press **[enter]**.

Note...

The settings for the sequential calling tones are stored via the calling tones menu in UTILITIES, see Fig. 3-1-26. These stores can be erased from the *Store Erase Menu.*

Store erase

Unlock to Level 1. Pressing *[Store Erase]* causes the *Store Erase Menu* to appear on the screen. The opportunity to erase all the stores of a given type is available by pressing the relevant key and then pressing *[Erase]*.

Frequency hopping

Carrier frequency hopping is a GPIB operation where the instrument can be instructed to hop between any of the frequencies contained in the carrier frequency stores and a sequence of up to 1024 hops may be entered. The time interval between hops can also be entered .

Before executing a carrier hopping sequence, the frequencies must be loaded into the carrier frequency stores (0 - 99). This can be achieved via the GPIB using the following commands -

CFRQ < frequency value >
STO:CFRQ < store number >

To enter the frequency hopping mode, enter the following GPIB commands -

IMODE SWEEPER
SWEEP:TYPE HOP

This will cause the screen as shown in Fig. 3-1-40 to appear on the signal generator -

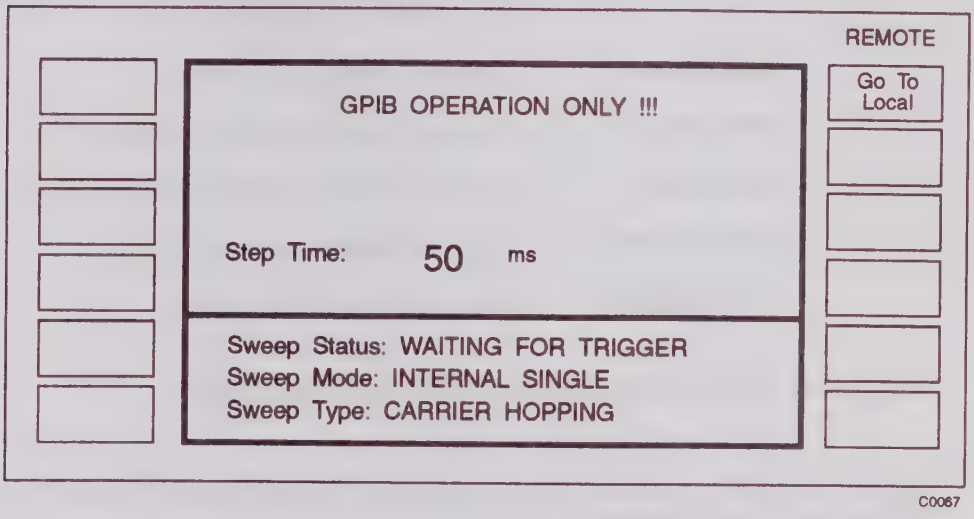

Fig. 3-1-40 Frequency hopping menu

To load in a sequence, the following command is used -

HOPSEQ<n0>,<n1>,<n2>,<n3>,<n4>.....

where <n0> - <n> are numeric values in the range 0-99 corresponding to the carrier frequency store at which the necessary frequency is stored. The hopping sequence length is determined by the amount of numbers entered.

The other parameter that can be set to control the hopping sequence is the time between steps. This is done using the command -

SWEEP:HOP:TIME < t >

where t represents the number of milliseconds.

The 100 frequencies are precalculated and loaded into a software sweep table using the GPIB command -

SWEEP:CALC

Note:...

If any of the carrier frequency stores have become corrupt and so result in a checksum error, the following message will appear in the centre of the screen -

CARRIER STORE < x > CORRUPTED.
RE - ENTER FREQUENCY.

where x is the corrupted store number.

With the frequencies, sequence and step time loaded, the hopping operation is controlled in the same manner as the ordinary sweeps by using the following commands -

SWEEP:GO	starts the hopping sequence (and will do any precalculation if required).
SWEEP:HALT	pause the hopping sequence.
SWEEP:UP	go up to the next step while paused.
SWEEP:DN	go down to previous step while paused.
SWEEP:CONT	continue hopping sequence.
SWEEP:RESET	reset sequence to start value.

When paused the carrier store number is displayed on the screen.

Note...

There are no markers available and the operation of transferring the paused value to the main parameter is not permitted.

To enter a new sequence use the HOPSEQ command but the number 255 is inserted at the beginning of the string.

e.g. existing sequence - 0, 6, 53, 72, 43, 96
sequence required - 22, 16, 7, 41, 59, 66
send GPIB command -

```
HOPSEQ  255,22,16,7,41,59,66
```

To add to an existing sequence use the HOPSEQ command without 255 at the beginning of the string.

e.g. existing sequence - 12, 24, 36, 48
sequence required - 12, 24, 36, 48, 60, 72, 84
send GPIB command -

```
HOPSEQ  60,72,84
```

To determine the length of the hopping sequence the following GPIB command is used -

```
HOPSEQ?
```

This returns a value 1 - 1024.

Like other sweep settings the frequency hopping mode can be set to -

single sweep (internal trigger),
continuous sweep (internal trigger) or
external sweep (external trigger)

by using the following commands -

SWEEP:MODE SNGL
SWEEP:MODE CONT
SWEEP:MODE EXT

For externally triggered operation the trigger facility can be used in the same manner as another sweep function.

ERROR HANDLING

Errors may be divided into three groups - foreground errors generally caused by a user, background errors which represent a condition of the instrument and GPIB errors which occur only when the unit is being controlled by a GPIB controller.

Foreground errors

Attempts to set the instrument to a parameter value outside its known range result in the generation of an error message.

For example, trying to select a carrier frequency above or below the specified range results in the message *Carrier Outside Limits* being displayed at the top of the screen.

Foreground errors are cleared automatically when a correct entry is made by the user.

Background errors

An incorrect operating condition within the instrument automatically generates an error message to warn the operator. For example, if the internal frequency standard should fail the message *Int. Standard Failure* will be displayed at the top of the screen.

GPIB errors

Errors caused by incorrect programming are displayed at the top of the screen and may also generate a Service Request if the relevant status registers are set.

Error display - Front panel

Errors are displayed as a single line of text at the top of the screen. If more than one error is present an internal priority ordering algorithm determines which error is displayed.

Error display - GPIB

When an error occurs, its number is entered into the Error Queue. Errors are not removed from the queue when they are cleared, but only by the ERROR? query, which returns the error at the head of the queue, or by the *CLS command which clears the whole queue. When the queue contains an error entry, a bit (<erb>) on the status byte is set (see Page 3-2-47).

The error queue has a capacity of 100 error numbers. If an error occurs while the queue is full the last error number is replaced with 255 so that the ERROR? query returns a value of 255 to indicate a full queue. An empty queue returns a value of 0 following an ERROR? query.

In addition to the error queue entry, the appropriate bit in the Standard Event Register (see Page 3-2-42) will also be set (one of <cmd>, <exe>, <dde> or <qye>). Many background errors are also reported in the Hardware and Coupling Status Registers (see Page 3-2-43 and 3-2-44).

ERROR MESSAGES

TABLE 3-1-2 BACKGROUND ERRORS

Error No.	Error Type	Descriptive text	Error No.	Error Type	Descriptive text
1	dde	RPP Tripped	6	dde	VCXO Out of Lock
2	dde	Fractional N Out of Lock	7	dde	Ext1 Too Low
3	dde	Int. Standard Failure	8	dde	Ext1 Too High
4	dde	Ext. Standard Failure	9	dde	Ext2 Too Low
5	dde	Incorrect Ext. Standard	10	dde	Ext2 Too High
11	-	-	16	-	-
12	-	-	17	exe	RF Level limited by AM
13	-	-	18	exe	FM limited by Carrier
14	-	-	19	exe	WBFM limited by Carrier
15	-	-	20	exe	AM2 limited by AM1
21	exe	FM2 limited by FM1	26	dde	Real Time Clock Problem
22	exe	PM2 limited by PM1	27	dde	Calibration Date Expired
23	exe	Steps limited by Span	28	dde	Pad Calibration Checksum
24	exe	FM Selfcal Error	29	dde	RF Calibration Checksum
25	dde	Internal Osc.1 Missing	30	dde	FM Calibration Checksum
31	dde	Path/Source Calibration	36	-	-
32	dde	Absolute Mod. Calibration	37	-	-
33	dde	Freq. Std. Calibration	38	-	-
34	-	-	39	-	-
35	-	-	40	-	-

TABLE 3-1-3 FOREGROUND ERRORS

Error No.	Error Type	Descriptive text	Error No.	Error Type	Descriptive text
46	exe	Recall Checksum	51	exe	Carrier Outside Limits
47	exe	Incorrect Setup	52	exe	RF Level Outside Limits
48	exe	Invalid Memory Number	53	exe	Mod Rate Outside Limits
49	exe	MODULATION NOT ENABLED	54	exe	LF Freq. Outside Limits
50	exe	Out of Range	55	exe	LF Level Outside Limits
56	exe	AM Outside Limits	61	exe	RF Level Step Too Big
57	exe	FM Outside Limits	62	exe	Mod Rate Step Too Big
58	exe	PM Outside Limits	63	exe	LF Freq. Step Too Big
59	exe	WBFM Outside Limits	64	exe	LF Level Step Too Big
60	exe	Carrier Step Too Big	65	exe	AM Step Too Big
66	exe	FM Step Too Big	71	exe	Sweep Stop Out of Range
67	exe	PM Step Too Big	72	exe	Sweep Steps Out of Range
68	exe	Invalid Latch Number	73	exe	Sweep Time Out of Range
69	exe	Invalid Latch Data	74	exe	Sweep Marker Out of Range
70	exe	Sweep Start Out of Range	75	exe	Attenuator EAROM Read

TABLE 3-1-3 FOREGROUND ERRORS (continued)

76	exe	Attenuator EAROM Write	81	exe	EAROM Wrap Around Error
77	-	-	82	exe	Continuous Tone Checksum
78	-	-	83	exe	Sequential Tone Checksum
79	exe	EAROM Write Error	84	exe	Tone data Out of Range
80	exe	EAROM Read Error	85	exe	Tone Offset Out of Range
86	exe	Clock Data Entry Error	91	exe	RF levelling fault
87	exe	At Top Limit	92	exe	REPEAT THIS CALIBRATION
88	exe	At Bottom Limit	93	-	-
89	exe	Ext. Trigger Disabled	94	-	-
90	dde	Int. Std. Not Selected	95	-	-

TABLE 3-1-4 GPIB ERRORS

Error		Descriptive text	Error		Descriptive text
No.	Type		No.	Type	
101	-	-	106	cmd	Data Expected
102	cmd	Mnemonic Fault	107	cmd	Illegal Data
103	cmd	Block Definition	108	cmd	Terminator Expected
104	cmd	Block Size	109	cmd	GET Error
105	cmd	Numeric Syntax	110	cmd	EOM Error
111	exe	Illegal Modulation Mode	116	qye	Unterminated
112	exe	No Such Monitor Mode	117	qye	Interrupted
113	exe	Cannot Monitor	118	qye	Deadlock
114	exe	Instrument Mode Wrong	119	cmd	Missing Quote
115	cmd	Lost Data After Comma	120	cmd	Terminator Expected
121	exe	String Length	126	exe	Illegal Seq Tones Mode
122	exe	Illegal Tone Character	127	exe	Overflow
123	exe	Illegal Duration Char	128	cmd	Data Too Long
124	exe	Illegal Standard	129	exe	Voltage Type Error
125	exe	Illegal Save Destination	130	exe	Sweep Not Possible
131	exe	Unknown Cal Point	136	exe	Unknown Freq. Standard.
132	exe	Unknown RF Band	137	exe	User Data Locked
133	exe	Unknown Instrument Mode	138	exe	Trigger Unknown
134	exe	User Data Checksum	139	exe	Illegal Tones Operation
135	qye	Query Lost after arb. char	140	cmd	Error in Char Data
141	exe	Wrong RF units	146	exe	Wrong Family For Command
142	cmd	Data Unknown	147	exe	Not Suitable For Hopping
143	exe	Negative Value Illegal	148	exe	Hopping Sequence Full
144	exe	Illegal Modulation Mode	149	-	-
145	exe	Unavailable Mod Source	150	-	-

TABLE 3-1-5 FATAL ERRORS

Error		Descriptive text	Error		Descriptive text
No.	Type		No.	Type	
171	exe	Main RAM Faulty	176	-	-
172	exe	Main PROM Faulty	177	-	-
173	exe	Microwave Board Error	178	-	-
174	exe	Attenuator Type Unknown	179	-	-
175	exe	Wrong Attenuator fitted	180	-	-

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Chapter 3-2
GPIB OPERATION

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INTRODUCTION

The 2030 Series signal generators can be operated remotely from a personal computer fitted with a GPIB interface card or a dedicated GPIB controller. All functions can be controlled by coded messages sent over the interface bus via the 24 way socket on the rear panel of the instrument. IEEE Standard 488.2 (1987) is implemented, which defines the protocols and syntax of commands.

The instrument can function either as a talker or a listener. In the listen mode, it will respond to IEEE 488.2 common commands and queries and device-specific commands and queries. These allow various device functions to be controlled and operating parameters to be set. In the talk mode, device status information and parameter settings can be read from the instrument.

For full information on the IEEE protocols and syntax the IEEE 488.2 Standard should be consulted.

GPIB FUNCTIONS

The IEEE 488.1 interface functions offered by 2030 Series are as follows:

Source handshake (SH1)	complete capability.
Acceptor handshake (AH1)	complete capability.
Talker (T6)	basic talker, serial poll, unaddress if MLA.
Listener (L4)	basic listener, unaddress if MTA.
Service Request (SR1)	complete capability.
Remote/Local (RL1)	complete capability.
Device clear (DC1)	complete capability.
Device trigger (DT1)	complete capability
Parallel Poll (PP0)	no capability.
Controller (C0)	no capability.
Tri-state drivers (E2)	as opposed to open collector drivers.

DEVICE LISTENING ELEMENTS

The following is a list of the device listening elements (as defined in the IEEE 488.2 standard) which are used in the 2030 Series of signal generators:

<PROGRAM MESSAGE>
<PROGRAM MESSAGE TERMINATOR>
<PROGRAM MESSAGE UNIT>
<PROGRAM MESSAGE UNIT SEPARATOR>
<COMMAND MESSAGE UNIT>
<QUERY MESSAGE UNIT>
<COMPOUND COMMAND PROGRAM HEADER>
<COMPOUND QUERY PROGRAM HEADER>
<PROGRAM HEADER SEPARATOR>
<PROGRAM DATA>
<PROGRAM DATA SEPARATOR>
<DECIMAL NUMERIC PROGRAM DATA>
<CHARACTER PROGRAM DATA>
<SUFFIX PROGRAM DATA>
<STRING PROGRAM DATA>
<ARBITRARY BLOCK PROGRAM DATA>

DEVICE TALKING ELEMENTS

The following is a list of the device talking elements (as defined in the IEEE 488.2 standard) which are used in the 2030 Series of signal generators:

<RESPONSE MESSAGE>
<RESPONSE MESSAGE TERMINATOR>
<RESPONSE MESSAGE UNIT>
<RESPONSE MESSAGE UNIT SEPARATOR>
<COMPOUND RESPONSE HEADER>
<RESPONSE HEADER SEPARATOR>
<RESPONSE DATA>
<RESPONSE DATA SEPARATOR>
<NR1 NUMERIC RESPONSE DATA>
<NR2 NUMERIC RESPONSE DATA>
<ARBITRARY ASCII RESPONSE DATA>
<CHARACTER RESPONSE DATA>
<STRING RESPONSE DATA>
<DEFINITE LENGTH ARBITRARY BLOCK RESPONSE DATA>

PROGRAMMING

Program messages

A message consists of one or more message units. Message units are separated by a semi-colon (;). The whole message is ended by the Program Message Terminator (or End Of Message) defined as one of the following:

(1) <newline> (ASCII 10 - often known as 'line feed') or
(2) <newline> + END (the EOI line is asserted as well) or
(3) + END (EOI is asserted in the last data byte of the message)

Note ...

A response message is always terminated by <EOM> consisting of <newline> + END.

A message unit consists of a mnemonic header which may be followed by data. If data follows, then it must be separated from its header by at least one space

<header><SPACE><data>
e.g. RFLV:INC 6.0 dB

Spaces may be freely inserted in a message to improve readability, except within a header or within data.

A header may be a command or a query. A query has a '?' as its final character and causes the generation of a response message which will be read by the controller. Common commands and queries (defined in IEEE 488.2) begin with a '*'.

Upper and lower case characters are considered equivalent (i.e. FM fm Fm fM are all interpreted by the 2030 Series in the same way).

Compound headers

The 2030 Series implements compound headers which allow a complex set of commands to be built up from a small set of basic elements in a 'tree and branch' structure. The elements of a compound header are separated by a colon (:). Spaces are not allowed within a header.

Special rules apply when more than one compound header is used in one message. When the separator ';' is encountered, all headers except the trailing element of the previous header in the message are assumed to precede the following header, for example:

AM:DEPTH 30PCT;ON

is equivalent to the two commands:

AM:DEPTH 30PCT
and AM:ON

This does not apply to common commands (*RST etc.). The rule may be overridden by preceding a header with a colon, for example:

AM:ON;:FM:ON

Most main functions have a short form of header which may be used for clarity and brevity in simple messages, for example:

CFRQ 1.25GHZ is the same as CFRQ:VALUE 1.25GHZ

Program data

Data can take many forms, as follows:

Decimal Numeric Data is a flexible numeric format which encompasses integer, fixed point and floating point (mantissa and exponent) representations. Data is rounded to a resolution appropriate to the function. Decimal data can, in most cases, be followed by the appropriate units. If no units are present, the specified default units are assumed.

Character Data is an alphanumeric word.

String Data consists of a number of 7-bit ASCII characters enclosed in quotes, either a pair of single ('ASCII 39') or double ("ASCII 34") quotes may be used.

Block Data is used by *PUD and allows a number of 8-bit bytes to be transferred. For further information see the Service Manual.

Some commands can accept Multiple Data items which are separated by commas, for example MODE FM,AM.

Message exchange protocol

The controller should not attempt to read a response until it has sent the entire query message (terminated by EOM). Also, it should not start to send a new message until it has read the entire response (terminated by EOM). The query message may contain more than one query message unit, but only one response message (containing several response message units) is generated.

Failure to follow the protocol will generate a query error:

UNTERMINATED (error 116) occurs when the controller attempts to read a response without having sent a query.

INTERRUPTED (error 117) occurs when the controller starts to send a new message before having read the response to a preceding query.

DEADLOCK (error 118) can only occur if the input and output buffers are both filled by the controller having sent an extra long Message containing several query message units.

The 2030 Series have input buffer stores of 256 characters and an output buffer of two response message units.

Remote/local operation

When the 2030 Series Signal Generator is addressed by the controller it will enter its remote mode and the screen will have only one key legend, *[LOCAL]*. Pressing this key returns the unit to normal manual operation, unless Local Lockout has been asserted by the controller.

Common commands and queries (IEEE 488.2)

The IEEE 488.2 standard defines a set of common commands and queries which implement common system functions.

Common command and query mnemonics are preceded by an asterisk (*) to distinguish them from device dependent data such as instrument programming strings. The following common commands and queries are implemented in the 2030 Series:

Mnemonic	Name and Description
*IDN?	Identification Query. Returns an arbitrary ASCII response comprising four data fields in the format: <Manufacturer>,<type number>,<serial number>,<firmware version number><EOM>. Example: `MARCONI INSTRUMENTS,2031,123456789,2.001<EOM>`
*OPT?	Option Identification Query. Returns an arbitrary ASCII response containing a data field for each fitted option in the format: <option a>,<option d>, ... ,<option *n*><EOM> Example: `SECOND OSCILLATOR,PULSE MODULATION,+19 dBm OUTPUT<EOM>` If no options are fitted, ASCII '0' is returned.

Note...

Because an Arbitrary ASCII Response ends with the Response Message Terminator (<EOM>) either *IDN? or *OPT? must be the last Query Message Unit in a Program Message.

*RST	Reset Command. Sets the instrument functions to the factory default power up state. The default settings appear in Table 3-2-1.
*TST?	Self Test Query. Returns a '0' when the GPIB interface and processor are operating.
*OPC	Operation Complete Command. Sets the Operation Complete bit in the Standard Event Status Register when execution of the preceding operation is complete.
*OPC?	Operation Complete Query. Returns a '1' when the preceding operation has been completed.
*WAI	Wait to Continue Command. Inhibits execution of an overlapped command until the execution of the preceding operation has been completed.
*TRG	Trigger Command. Equivalent to Group Execute Trigger.

*PUD <block>	Protected User Data Command. Sets the Protected User Data, accepts Definite Block Data when enabled. This command is covered in further detail in the Service Manual.
*PUD?	Protected User Data Query. Returns the User Data as a Definite Block Response.
Example:	`#221Inventory Number 1234`
*STB?	Read Status Byte Query. Returns the value of the Status Byte as an nr1 number (0-255).
*SRE <nrf>	Service Request Enable Command. Sets the Service Request Enable Register.
*SRE?	Service Request Enable Query. Returns the value of the Service Request Enable Register as nr1.
*ESR?	Standard Event Status Register Query. Returns the value of the Status Event Status Register as nr1.
*ESE <nrf>	Standard Event Status Enable Command. Sets the Standard Event Enable Register.
*ESE?	Standard Event Status Enable Query. Returns the value of the Standard Event Status Enable Register as nr1.
*CLS	Clear Status Command. Clears all the Status Event registers and clears the Error Queue. Does not affect the Enable Registers.

Note...

The IEEE 488.2 Device Clear function only affects the GPIB functions. The input and output buffers are cleared and the instrument put into a state to accept new Messages. It no longer puts the instrument functions into a defined state, this is now performed by the *RST common command.

DEVICE DEPENDENT COMMANDS

The following list describes the features of the device dependent mnemonics for the 2030 Series signal generators together with simple examples of their use within each major section (Carrier frequency, RF Level, etc.) the root mnemonic is listed first followed by the lower level mnemonics. Each group is followed by a list of requirements for data type and suffix.

In addition to the normal listen commands the 2030 Series accept query commands which cause the instrument to prepare a message which will be sent to the controller when the instrument is next addressed to talk. For each query an example of a response is given. Where responses are similar for a group of queries not all are listed. Some queries can produce more than one type of response - an example of each is usually given.

In the list which follows, the abbreviations <char>, <nrf> and <str> have the following meanings:

<char> = Character Program Data
<nrf> = Decimal Numeric Program Data
<str> = String Program Data

Where the data format is Decimal Numeric Program Data, the value may be expressed as a signed or unsigned number in any of the following formats:

nr1: Decimal integer, e.g. 1234 or -567
nr2: Floating point number, e.g. 1.234 or -56.789
nr3: Floating point number with exponent, e.g. 1.2345E5 or -12.47E-8

DEFAULT SETTINGS

These are the settings assigned to instrument functions in the following cases:

(i) Power-up to factory default settings.

(ii) Execution of *RST command.

(iii) Recall Full Store 50.

The instrument functions set to the factory default power-up state by the reset command (*RST) are as shown in Table 3-2-1

TABLE 3-2-1 INSTRUMENT DEFAULT SETTINGS

Instrument Mode	:	Normal
Carrier Frequency	:	(Maximum available) 1.35 GHz/2.7 GHz/5.4 GHz
Step	:	1 kHz
RF Level	:	(Minimum available) -138 dBm/-144 dBm
Step	:	1 dB Status: ON
Modulation Mode	:	Single FM , Modulation enabled

TABLE 3-2-1 INSTRUMENT DEFAULT SETTINGS (continued)

Modulations	:	FM1	:	0 Hz, Int F4, ON
		FM2	:	0 Hz, Ext 1 ALC, ON
		ΦM1	:	0 rad, Int F4, ON
		ΦM2	:	0 rad, Ext 1 ALC, ON
		AM1	:	0%, Int F4, ON
		AM2	:	0%, Ext 2 ALC, ON
		WBFM	:	(Minimum setting), AC coupled, ON
Steps :		ΔFM 1 kHz, Δ ΦM 0.1 rad, ΔAM 1%		
Modulation source	:	IntF1	:	300 Hz sine
		IntF2	:	400 Hz sine
		IntF3	:	500 Hz sine
		IntF4	:	1 kHz sine
		IntF5	:	3 kHz sine
		IntF6	:	6 kHz sine
Step :		1 kHz		
LF	:	Mode	:	Monitor, Mod Source
LF Generator	:	Frequency	:	1 kHz sine, step 1 kHz
		Level	:	100 µV
		Step	:	1 dB
		Status	:	ON

Sweep:		
Type	:	RF Level
Mode	:	Single Internal
RF Level Sweep :		
Start :		0 dBm Stop: 10 dBm Steps: 100 Time: 50 ms
Markers :		2, 4, 6, 8, 10 dBm, disabled
Carrier Freq. Sweep :		
Start :		100 MHz Stop: (Maximum available) Steps: 250 Time 50 ms
Markers :		200, 400, 600, 800, 1000 MHz, disabled
Mod. source Freq.	:	
Start :		0.1 Hz Stop: 500 kHz Steps: 10,000 Time: 500 ms
Markers :		100, 20, 30, 400, 500 kHz

Sequential Tones :	
Mode :	No modulation selected.
Standard :	CCIR
Sequence :	16 Tone Fs
Duration :	All normal.
Frequency Offset :	0
Extended Duration :	500 ms
Repeat Tone :	E
Start Delay :	200 ms

INSTRUMENT MODE

IMODE Select instrument mode

Data type : Character Program Data (either NORMAL for signal generator operation or SWEEPER for swept operation)
Allowed suffices : None
Default suffix : None

Example: `IMODE NORMAL`

CARRIER FREQUENCY

CFRQ Set Carrier Frequency (short form)
:VALUE Set Carrier Frequency
:INC Set Carrier Frequency step

Data type : Decimal Numeric Program Data
Allowed suffices : Any one of: GHZ, MHZ, KHZ or HZ
Default suffix : HZ

:UP Go UP one step
:DN Go DOWN one step
:RET Return to original setting
:XFER Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

:PHASE Adjust Phase of Carrier in steps of $\pi/128$ radians (approximately 1.4°) over a range of ±255 steps

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

Examples:
```
CFRQ:VALUE 1.23MHZ;INC 10KHZ
CFRQ:UP;XFER
```

CFRQ? Prepares message containing information on Carrier Frequency setting in the following format:

:CFRQ:VALUE <nr2>; INC <nr2>

Example: `:CFRQ:VALUE 1000000000.0;INC 25000.0`

RF LEVEL

RFLV — Set RF output level (short form)

:VALUE — Set RF output level

Data type : Decimal Numeric Program Data
Allowed suffices : Any one of: DBM, DBV, DBMV, DBUV, V, MV or UV
Default suffix : dBm unless changed by UNITS command

:INC — Set RF level step (dB)

Data type : Decimal Numeric Program Data
Allowed suffices : DB only
Default suffix : DB

:UP — Go UP one step
:DN — Go DOWN one step
:RETN — Return to original setting
:XFER — Transfer current value to be the new setting
:ON — Turn RF output ON
:OFF — Turn RF output OFF

Data type : None
Allowed suffices : None
Default suffix : None

:TYPE — Selects EMF or PD for voltage related units

Data type : Character Program Data (EMF or PD)
Allowed suffices : None
Default suffix : None

:UNITS — Select default RF level units.

Data type : Character Program Data (DBM, DBV, DBMV, DBUV, V, MV or UV)
Allowed suffices : None
Default suffix : None

Examples:

```
RFLV:VALUE [illegible]DBV;ON
RFLV:TYPE PD;VALUE 1.23UV
```

RFLV (continued)

:OFFS [not used alone]
:VALUE Set Offset of current band

Data type : Decimal Numeric Program Data
Allowed suffices : DB only
Default suffix : DB

:ON Turn ON offset of current band
:OFF Turn OFF offset of current band
:ENABLE Enable Offsets
:DISABLE Disable Offsets
:SAVE Store Offsets in memory

Data type : None
Allowed suffices : None
Default suffix : None

Example: `RFLV:OFFS:VALUE -0.2DB;ON;ENABLE`

RFLV?

Prepares message containing information on RF Level setting in the following format:

:RFLV:UNITS <unit>;TYPE <type>;VALUE <nr2>;INC <nr2>;<status>

where: <unit> is character program data defining the default RF level units (DBM, DBV, DBMV, DBUV, V, MV or UV), <type> is character program data indicating EMF or PD and <status> is a program mnemonic indicating whether the RF output is ON or OFF.

Examples:
```
:RFLV:UNITS DBM;VALUE -103.5;INC 2.0;ON
:RFLV:UNITS DBV;TYPE EMF;VALUE -83.2;INC 0.5;ON
```

RFLV:OFFS?

Prepares message containing information on RF Level offsets in the following format:

:CFRQ:VALUE <nr2>;:RFLV:OFFS:VALUE <nr2>;<status>;<activity>

where: <status> is a program mnemonic indicating whether the RF offset is ON or OFF and <activity> is a program mnemonic indicating whether the offset mode is enabled or disabled.

Example: `:CFRQ:VALUE 500000000.0;:RFLV:OFFS:VALUE -0.4;ON;ENABLE`

RFLV (continued)

RFLV
:HYST [not used alone]
:ENABLE Enable Extended Hysteresis mode
:DISABLE Disable Extended Hysteresis mode

Data type : None
Allowed suffices : None
Default suffix : None

:RFLV:HYST? Responds with status as follows:

:RFLV:HYST:ENABLE
or :RFLV:HYST:DISABLE

RFLV
:OVER [not used alone]
:ENABLE Enable Overrange mode
:DISABLE Disable Overrange mode

Data type : None
Allowed suffices : None
Default suffix : None

:RFLV:OVER? Responds with status as follows:

:RFLV:OVER:ENABLE
or :RFLV:OVER:DISABLE

MODULATION MODE

MODE Set modulation mode

Data type : Character Program Data (valid combinations of AM, AM1, AM2, FM, FM1, FM2, PM, PM1, PM2, WBFM or PULSE, see Table below)
Allowed suffices : None
Default suffix : None

Examples:
```
MODE AM,FM
MODE FM1,FM2
```

VALID MODE COMBINATIONS TABLE

Single	Composite	Dual	Dual Composite
AM1	AM1,AM2	AM1,FM1	AM1,AM2,FM1,FM2
FM1	FM1,FM2	AM1,PM1	AM1,AM2,PM1,PM2
PM1	PM1,PM2	AM1,WBFM	AM1,AM2,WBFM
WBFM		PULSE,FM1	PULSE,FM1,FM2
PULSE		PULSE,PM1	PULSE,PM1,PM2
		PULSE,WBFM	

Note...

At any time the '1' may be omitted, for example FM is equivalent to FM1. Order is not important, for example AM,FM is equivalent to FM,AM.

For instruments without pulse modulation (Option 002) fitted, select Low Intermodulation mode by using character data type PULSE.

MODE? Prepares message containing information on Modulation Mode in the following format:

:MODE:<mode>

where: <mode> is character program data indicating the modulation mode settings.

Example:
```
:MODE FM1,FM2
```

MODULATION CONTROL

MOD [not used alone]
:ON Turn modulation globally ON
:OFF Turn modulation globally OFF

Examples:
```
MOD:ON
MOD:OFF
```

MOD? Prepares message containing information on Modulation Control in the following format:

:MOD:<status>

where: <status> is a program mnemonic indicating whether the Modulation is globally ON or OFF.

Example:
```
:MOD:ON
```

FREQUENCY MODULATION

FM or FM1 or FM2 — Set FM deviation (short form)
:DEVN — Set FM deviation
:INC — Set FM step size

Data type : Decimal Numeric Program Data
Allowed suffices : Any one of: GHZ, MHZ, KHZ or HZ
Default suffix : HZ

:<src> — Select modulation source where <src> is any one of: INTF1, INTF2, INTF3, INTF4, INTF5, INTF6, EXT1DC, EXT1AC, EXT1ALC, EXT2DC, EXT2AC or EXT2ALC
:ON — Turn FM ON (locally)
:OFF — Turn FM OFF (locally)
:UP — Go UP one step
:DN — Go DOWN one step
:RETN — Return to original setting
:XFER — Transfer current value to be the new setting

DCFMNL — Perform DC FM/WBFM null operation

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
FM:DEVN 25KHZ;INTF4;ON
FM1:DEVN 15KHZ;INC 1KHZ;EXT1DC
DCFMNL
```

FM? or FM1? or FM2? — Prepares message containing information on FM setting in one of the following formats:

:FM:DEVN <nr2>;<src>;<status>;INC <nr2>
:FM1:DEVN <nr2>;<src>;<status>;INC <nr2>
:FM2:DEVN <nr2>;<src>;<status>;INC <nr2>

where: <src> is a program mnemonic representing the source of the modulation signal and <status> is a program mnemonic indicating whether the modulation is locally ON or OFF

Example:
```
:FM1:DEVN 25000.0;INTF1;ON;INC 1000.0
```

PHASE MODULATION

PM or PM1 or PM2 — Set Phase deviation (short form)

:DEVN — Set Phase deviation

:INC — Set Phase Modulation step size

Data type : Decimal Numeric Program Data
Allowed suffices : RAD or RADS
Default suffix : RAD

:<src> — Select modulation source where <src> is any one of: INTF1, INTF2, INTF3, INTF4, INTF5, INTF6, EXT1DC, EXT1AC, EXT1ALC, EXT2DC, EXT2AC or EXT2ALC

:ON — Turn PM ON (local)

:OFF — Turn PM OFF (local)

:UP — Go UP one step

:DN — Go DOWN one step

:RETN — Return to original setting

:XFER — Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

Examples:

```
PM:DEVN 2.5RAD;INTF4;ON
PM1:DEVN 1.5RAD;INC 0.1RAD;EXT1AC
```

PM? or PM1? or PM2? — Prepares message containing information on Phase Modulation setting in one of the following formats:

:PM:DEVN <nr2>;<src>;<status>;INC <nr2>
:PM1:DEVN <nr2>;<src>;<status>;INC <nr2>
:PM2:DEVN <nr2>;<src>;<status>;INC <nr2>

where <src> is a program mnemonic representing the source of the modulation signal and <status> is a program mnemonic indicating whether the modulation is locally ON or OFF

Example:

```
:PM2:DEVN 2.30;INTF4;OFF;INC 0.05
```

AMPLITUDE MODULATION

AM or AM1 or AM2 — Set AM Depth (short form)
:DEPTH — Set AM Depth
:INC — Set AM step size

Data type : Decimal Numeric Program Data
Allowed suffices : PCT
Default suffix : PCT

:<src> — Select modulation source where <src> is any one of: INTF1, INTF2, INTF3, INTF4, INTF5, INTF6, EXT1DC, EXT1AC, EXT1ALC, EXT2DC, EXT2AC or EXT2ALC

:ON — Turn AM ON (local)
:OFF — Turn AM OFF (local)
:UP — Go UP one step
:DN — Go DOWN one step
:RETN — Return to original setting
:XFER — Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
AM:DEPTH 30PCT;INTF4;ON
AM1:DEPTH 40PCT;EXT1DC;ON
```

AM? or AM1? or AM2? — Prepares message containing information on Amplitude Modulation setting in one of the following formats:

:AM:DEPTH <nr2>;<src>;<status>;INC <nr2>
:AM1:DEPTH <nr2>;<src>;<status>;INC <nr2>
:AM2:DEPTH <nr2>;<src>;<status>;INC <nr2>

where <src> is a program mnemonic representing the source of the modulation signal and <status> is a program mnemonic indicating whether the modulation is locally ON or OFF

Example:
```
:AM1:DEPTH 56.6;INTF3;ON;INC 5.0
```

WIDEBAND FM

WBFM Set WBFM deviation (short form)

:DEVN Set WBFM deviation

Data type : Decimal Numeric Program Data
Allowed suffices : Any one of: GHZ, MHZ, KHZ or HZ
Default suffix : HZ

:ON Turn WBFM ON (local)
:OFF Turn WBFM OFF (local)
:AC Select AC coupling
:DC Select DC coupling

Data type : None
Allowed suffices : None
Default suffix : None

DCFMNL Perform DC FM/WBFM null operation

Examples:
```
WBFM:DEVN 10MHZ;ON;AC
WBFM:DEVN 13MHZ;ON;DC;:DCFMNL
```

WBFM? Prepares message containing information on Wideband Frequency Modulation setting in the following format:

:WBFM:DEVN <nr2>;<coupling>;<status>

where <coupling> is a program mnemonic indicating AC or DC coupling of the modulation signal and <status> is a program mnemonic indicating whether the modulation is locally ON or OFF

Example:
```
:WBFM:DEVN 500000.0;AC;ON
```

PULSE MODULATION

PULSE [not used alone]
:ON Turn Pulse modulation ON
:OFF Turn Pulse modulation OFF and select Low Intermodulation

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
PULSE:ON
PULSE:OFF
```

PULSE? Prepares message containing information on Pulse Modulation setting in the following format:

:PULSE:<status>

where: <status> is a program mnemonic indicating whether the modulation is ON or OFF

Examples:
```
:PULSE:ON
:PULSE:OFF
```

MODULATION FREQUENCY

INTF1 or INTF2 or INTF3 or INTF4 or INTF5 or INTF6 Set modulation oscillator frequency (short form)

:FREQ Set modulation oscillator frequency

:INC Set modulation oscillator frequency step size

Data type : Decimal Numeric Program Data
Allowed suffices : Any one of: GHZ, MHZ, KHZ or HZ
Default suffix : HZ

:SIN Select sinusoidal waveform
:TRI Select triangle wave
:UP Go UP one step
:DN Go DOWN one step
:RETN Return to original setting
:XFER Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

:PHASE Adjust Phase of Modulation Oscillator

Data type : Decimal Numeric Program Data
Allowed suffices : DEG
Default suffix : DEG

:CTC1 Select tone number (0 to 15) from Continuous Tone Group 1
:CTC2 Select tone number (0 to 15) from Continuous Tone Group 2
:USER Select tone number (0 to 15) from Continuous Tone USER group
:TEMP Select tone number (0 to 15) from Continuous Tone TEMP group

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

Examples:
```
INTF1:FREQ 1.5KHZ;SIN
INTF1:CTC1 3
```

INTF1, etc. (continued)

INTF1? or INTF2? or INTF3? or INTF4? or INTF5? or INTF6?

Prepares message containing information on modulation oscillator setting in one of the following formats:

:INTF1:FREQ <nr2>;INC <nr2>;<waveform>
:INTF6:<standard> <nr1>

where: <waveform> is a program mnemonic (SIN or TRI) indicating the waveform shape and <standard> is a program mnemonic (CTC1, CTC2, USER or TEMP) indicating the continuous tone signalling standard selected.

Examples:

```
:INTF2:FREQ 440.0;INC 100.0;SIN
:INTF3:CTC1 5
```

CTCSS TONES EDIT

CTONES [not used alone]

:EDIT [not used alone]

:TNUM Select tone number 0-15

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

:TFRQ Set tone frequency

Data type : Decimal Numeric Program Data
Allowed suffices : Any one of: GHZ, MHZ, KHZ or HZ
Default suffix : HZ

:LOAD Copy Standard to TEMP for editing

Data type : Character Program Data (any one of: CTC1, CTC2 or USER)
Allowed suffices : None
Default suffix : None

:SAVE Save TEMP to USER after editing for non-volatile storage (if required)

Data type : None
Allowed suffices : None
Default suffix : None

CTONES? [not used alone]

CTONES:EDIT? Prepares message containing information on the current tone number being edited and its frequency in the following format:

:CTONES:EDIT:TNUM <nr1>;TFREQ <nr2>

Example: `:CTONES:EDIT;TNUM 5;TFREQ 202.8`

SEQUENTIAL TONES

SEQT [not used alone]

:SEQ Set Tone sequence

Data type : String Program Data consisting of up to 16 characters from 0 to 9 and A to F between string delimiters (eg. "123C5" or '123C5'). For DTMF E and F are not allowed and are replaced by * and #.
Allowed suffices : None
Default suffix : None

:DUR Set Duration Mask

Data type : String Program Data consisting of up to 15 characters "-" or "E" between string delimiters (eg. "---E-" or '---E-')
Allowed suffices : None
Default suffix : None

:SEND Send Sequence *n* times where *n* has the value 1 to 9 indicating the number of tone sequences to be sent.

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

:STOP Stop sending sequence.

Data type : None
Allowed suffices : None
Default suffix : None

:MODE [not used alone]

:STD Select Tones standard

Data type : Character Program Data (any one of: CCIR, EURO, DZVEI, ZVEI1, ZVEI2, EEA, EIA, NATEL, TEMP, USER1, USER2 or DTMF).
Allowed suffices : None
Default suffix : None

:MOD Select Modulation Channel

Data type : Character Program Data (any one of: AM1, AM2, FM1, FM2, PM1, PM2, TOTAL_AM, TOTAL_FM, TOTAL_PM or NO_TONES)
Allowed suffices : None
Default suffix : None

SEQT (continued)

:PARAM	[not used alone]
:EXTD	Set the duration of the Extended tone.
:SDLY	Set Starting Delay
Data type :	Decimal Numeric Program Data
Allowed suffices :	MS
Default suffix :	MS
:SHFT	Set Frequency Shift (up to ±10.0%)
Data type :	Decimal Numeric Program Data
Allowed suffices :	PCT
Default suffix :	PCT
:RPTT	Select Repeat Tone
Data type :	String Program Data (any one of 0 to 9 or A to F between strings delimiters (eg. "E" or 'E').
Allowed suffices :	None
Default suffix :	None
:TDUR	Set DTMF Tone duration
:TGAP	Set DTMF inter-element gap
Data type :	Decimal Numeric Program Data
Allowed suffices :	MS
Default suffix :	MS
:EDIT	[not used alone]
:TNUM	Select Number of Tone to Edit
Data type :	Decimal Numeric Program Data
Allowed suffices :	None
Default suffix :	None
:TFRQ	Set Tone Frequency of tone selected by TNUM
Data type :	Decimal Numeric Program Data
Allowed suffices :	Any one of: GHZ, MHZ, KHZ or HZ
Default suffix :	HZ
:TDUR	Set Normal Tone Duration
:TGAP	Set Inter-element Gap
Data type :	Decimal Numeric Program Data
Allowed suffices :	MS
Default suffix :	MS
:LOAD	Load a Standard to TEMP for editing
Data type :	Character Program Data (any one of: CCIR, EURO, DZVEI, ZVEI1, ZVEI2, EEA, EIA, NATEL, USER1 or USER2)
Allowed suffices :	None
Default suffix :	None

SEQT:EDIT (continued)

:SAVE Copy TEMP to USER1 or USER2

Data type : Character Program Data (either USER1 or USER2)
Allowed suffices : None
Default suffix : None

Examples:
```
SEQT:SEQ "12245B7";DUR "----E--"
SEQT:MODE STD CCIR;MOD TOTAL_FM
SEQT:PARAM:EXTD 200MS;SHFT 0.5PCT
SEQT:EDIT:TNUM 3;TFRQ 1342.7HZ;SAVE USER1
```

SEQT?

Prepares message containing information on the signalling sequence and duration settings in the following format:

:SEQT:SEQ <toneseq>;DUR <durseq>

where: <toneseq> is string program data defining the tone sequence and <durseq> is string program data defining the duration sequence.

Examples:
```
:SEQT:SEQ "12245B7";DUR "----E--"
:SEQT:SEQ "12345*#9"          (DTMF ONLY)
```

SEQT:MODE?

Prepares message containing information on the signalling standard and the modulation channel selected in the following format:

:SEQT:MODE:STD <standard>;MOD <modchannel>

where: <standard> is a program mnemonic defining the tone standard and <modchannel> is character program data defining the modulation channel allocated to tone signalling.

Example:
```
:SEQT:MODE:STD ZVEI;MOD TOTAL_FM
```

SEQT:PARAM?

Prepares message containing information on signalling parameter settings in the following format:

:SEQT:PARAM:EXTD <nr1>;SHFT <nr2>;RPTT <rpt>;SDLY <nr1>

where: <rpt> is string program data defining the tone number used to represent the repeat tone.

Examples:
```
:SEQT:PARAM:EXTD 200;SHFT -1.6;RPTT "E";SDLY 300
:SEQT:PARAM:SDLY 30;TDUR 100;TGAP 75        (DTMF ONLY)
```

SEQT:EDIT?

Prepares message containing information on signalling editing in the following format:

:SEQT:EDIT:TNUM <nr1>;TFREQ <nr2>;TDUR <nr1>;TGAP <nr1>

Example: `:SEQT:EDIT:TNUM 3;TFREQ 1342.7;TDUR 40;TGAP 0`

LF CONTROL

LF [not used alone]

:ON Turn LF output ON

:OFF Turn LF output OFF

:GEN Select LF Generator

Data type : None
Allowed suffices : None
Default suffix : None

:MON Select source monitor mode

Data type : Character Program Data (any one of: AM1S, AM2S, AMD, ANG1S, ANG2S, ANGD or OFF, where AM represents Amplitude Modulation, ANG represents Angular Modulation, the suffix 'S' indicates Source and 'D' indicates Drive)
Allowed suffices : None
Default suffix : None

Examples:
```
LF:MON FM;ON
LF:MON ANGD
LF:GEN
```

LF? Prepares message containing information on the LF operation in one of the following formats depending on which LF mode is currently in use:

:LF:GEN;<status>
:LF:MON <source>;<status>

where: <source> is character program data representing the source being monitored and <status> is a program mnemonic indicating whether the output is ON or OFF.

Examples:
```
:LF:GEN;ON
:LF:MON AM1S;OFF
```

LF GENERATOR FREQUENCY

LFGF		Set LF Generator frequency (short form)
	:VALUE	Set LF Generator frequency
	:INC	Set LF Generator frequency step
	Data type :	Decimal Numeric Program Data
	Allowed suffices :	Any one of: GHZ, MHZ, KHZ or HZ
	Default suffix :	HZ
	:UP	Go UP one step
	:DN	Go DOWN one step
	:RETN	Return to original setting
	:XFER	Transfer current value to be the new setting
	:SIN	Select sinusoidal waveform
	:TRI	Select triangle wave
	Data type :	None
	Allowed suffices :	None
	Default suffix :	None

Example: `LFGF:VALUE 25KHZ;INC 500HZ`

LFGF? Prepares message containing information on LF Generator Frequency setting in the following format:

:LFGF:VALUE <nr2>;INC <nr2>

Example: `:LFGF:VALUE 25067.8;INC 500.0`

LF GENERATOR LEVEL

LFGL Set LF Generator level (short form)

:VALUE Set LF Generator level

Data type : Decimal Numeric Program Data
Allowed suffices : V, MV, UV, DBMV
Default suffix : V

:INC Set LF Generator level step

Data type : Decimal Numeric Program Data
Allowed suffices : DB
Default suffix : DB

:UP Go UP one step
:DN Go DOWN one step
:RETN Return to original setting
:XFER Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

:UNITS Select default LF level units

Data type : Character Program Data (DBM, DBV, DBMV, V, MV, or UV)
Allowed suffices : None
Default suffix : None

Examples:
```
LFGL:VALUE 75.6MV;INC 20DB
LFGL:UP
```

LFGL? Prepares the message containing information on LF Generator Level setting in the following format:

:LFGL:UNITS<unit>;VALUE<nr2>;INC<nr2>

where: <unit> is character programmed data defining the default LF level units (DBM, DBV, DBMV, V, MV or UV).

Example:
```
:LFGL:UNITS MV;VALUE 125.8;INC 1.0
```

MEMORY - STORE

STO	[not used alone]
:FULL	Full Store 0-49
:PART	Partial Store 0-49
:CFRQ	Carrier Freq Store 0-99
:SEQT	Sequential Tones Store 0-19
:SWEEP	Sweep Store 0-19

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

Examples:
```
:STO:FULL 17
:STO:CFRQ 83
```

MEMORY - RECALL

RCL	[not used alone]
:FULL	Recall Full 0-49
:FXCF	Recall Full 0-49 (without carrier frequency)
:PART	Recall Partial 0-49
:RXCF	Recall Partial 0-49 (without carrier frequency)
:CFRQ	Recall Carrier Freq 0-99
:SEQT	Recall Sequential Tones Sequence 0-19
:SWEEP	Recall Sweep 0-19

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

Examples:
```
:RCL:FULL 15
:RCL:CFRQ 75
```

MEMORY - ERASE

ERASE	[not used alone]
:FULL	Erase all Full Stores
:PART	Erase all Partial Stores
:CFRQ	Erase all Carrier Freq Stores
:SEQT	Erase all Sequential Tones Stores
:SWEEP	Erase all Sweep Stores
:ALL	Erase all Stores

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
:ERASE:FULL 12
:ERASE:ALL
```

SWEEP OPERATION

IMODE Select Instrument Mode

Data type : Character Program Data (either NORMAL for signal generator operation or SWEEPER for swept operation)
Allowed suffices : None
Default suffix : None

Example: `IMODE SWEEPER`

SWEEP [not used alone]

:MKRON Enable Sweep Markers
:MKROFF Disable sweep Markers

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
SWEEP:CFRQ:START 75MHZ;STOP 150MHZ;STEP 100;TIME 10MS
SWEEP:RFLV:START -56DBM;STOP  12DBM;STEP 440;TIME 25MS
SWEEP:CFRQ:MKRNUM 1;VALUE 83MHZ;MKRON
```

:CFRQ [not used alone]
:<cmd> Select Carrier Frequency sweep parameter entry where <cmd> is replaced by one of the commands (START, STOP, STEP, TIME, MKRNUM, MKRON, MKROFF or VALUE)

:RFLV [not used alone]
:<cmd> Select RF Level sweep parameter entry where <cmd> is replaced by one of the commands (START, STOP, STEP, TIME, MKRNUM, MKRON, MKROFF or VALUE)

:LFGF [not used alone]
:<cmd> Select LF Generator Frequency sweep parameter entry where <cmd> is replaced by one of the commands (START, STOP, STEP, TIME, MKRNUM, MKRON, MKROFF or VALUE)

:LFGL [not used alone]
:<cmd> Select LF Generator Level sweep parameter entry where <cmd> is replaced by one of the commands (START, STOP, STEP, TIME, MKRNUM, MKRON, MKROFF or VALUE)

:INTF [not used alone]
:<cmd> Select Internal Modulation Oscillator Frequency sweep parameter entry where <cmd> is replaced by one of the commands (START, STOP, STEP, TIME, MKRNUM, MKRON, MKROFF or VALUE)

HOP [not used alone]
:<cmd> Select Frequency Hopping sweep parameter entry where <cmd> is replaced by TIME.

SWEEP (continued)

:START Select start value of the parameter to be swept.
:STOP Select stop value of the parameter to be swept.

Data type : As used for the parameter
Allowed suffices : As used for the parameter
Default suffix : As used for the parameter

:STEP Select number of steps in the sweep.

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

:TIME Select time per sweep step

Data type : Decimal Numeric Program Data
Allowed suffices : MS
Default suffix : MS

:MKRNUM Select marker

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

:MKROFF Turn Current Marker OFF
:MKRON Turn Current Marker ON

Data type : None
Allowed suffices : None
Default suffix : None

:VALUE Set Value of Current Marker

Data type : Decimal Numeric Program Data
Allowed suffices : As used for the parameter
Default suffix : As used for the parameter

SWEEP? Prepares message containing information on Sweep Mode, Type and Marker status in the following format:

:SWEEP:MODE <mode>;TYPE <type>;<status>

where: <mode> is a program mnemonic representing the sweep mode selected, <type> is a program mnemonic representing the sweep type selected and <status> is a program mnemonic indicating whether the Marker output is ON or OFF.

Sample responses:
```
:SWEEP:MODE CONT;TYPE CFRQ;MKROFF
:SWEEP:TYPE HOP:MODE SNGL
```

SWEEP? (continued)

:CFRQ?

Prepares message containing information on Carrier Frequency Sweep settings in the following format:

:SWEEP:START <nr2>;STOP <nr2>;STEP <nr1>;TIME <nr1>;
MKRNUM <nr1>;<status>;VALUE <nr2>

where: <status> is a program mnemonic indicating whether the selected Marker is ON or OFF.

Sample response:

```
:SWEEP:START 1230000.0;STOP 1330000.0;STEP 100;
TIME 20;MKRNUM 2;MKRON;VALUE 1240000.0
```

:RFLV?

Prepares message containing information on RF Level Sweep settings in the following format:

:SWEEP:START <nr2>;STOP <nr2>;STEP <nr1>;TIME <nr1>;
MKRNUM <nr1>;<status>;VALUE <nr2>

where: <status> is a program mnemonic indicating whether the selected Marker is ON or OFF.

Sample response:

```
:SWEEP:START -107.0;STOP -27.0;STEP 80;TIME 50;
MKRNUM 2;MKRON;VALUE -97.0
```

:LFGF?

Prepares message containing information on LF Generator Frequency Sweep settings in the following format:

:SWEEP:START <nr2>;STOP <nr2>;STEP <nr1>;TIME <nr1>;
MKRNUM <nr1>;<status>;VALUE <nr2>

where: <status> is a program mnemonic indicating whether the selected Marker is ON or OFF.

Sample response:

```
:SWEEP:START 300.0;STOP 3000.0;STEP 2700;TIME 1;
MKRNUM 1;MKRON;VALUE 400.0
```

SWEEP? (continued)

:LFGL?

Prepares message containing information on LF Generator Level Sweep settings in the following format:

:SWEEP:LFGL:START <nr2>;STOP <nr2>;STEP <nr1>;TIME <nr1>; MKRNUM <nr1>;<status>;VALUE <nr2>

where: <status> is a program mnemonic indicating whether the selected Marker is ON or OFF.

Sample response:

```
:SWEEP:LFGL:START 1.0;STOP 120.0;STEP 120;TIME 10;
MKRNUM 2;MKRON;VALUE 5.0
```

:INTF?

Prepares message containing information on Modulation Oscillator Frequency Sweep settings in the following format:

:SWEEP:INTF:START <nr2>;STOP <nr2>;STEP <nr1>;TIME <nr1>; MKRNUM <nr1>;<status>;VALUE <nr2>

where: <status> is a program mnemonic indicating whether the selected Marker is ON or OFF.

Sample response:

```
:SWEEP:INTF:START 270.0;STOP 3300.0;STEP 500;TIME 1;
MKRNUM 4;MKRON;VALUE 2900.0
```

:HOP?

Prepares message containing information on Frequency Hopping Sweep in the following format:

:SWEEP:HOP:TIME<nr1>

SWEEP MODE/TYPE

SWEEP

:MODE

[not used alone]
Select Mode of operation for Sweep generator (single shot, continuous or externally triggered)

Data type : Character Program Data (any one of SNGL, CONT or EXT)
Allowed suffices : None
Default suffix : None

SWEEP (continued)

:TYPE Select Type of Sweep (Carrier Frequency, RF Level, LF Generator Frequency, LF Generator Level, Internal Modulation Oscillator Frequency or Off)

Data type : Character Program Data (any one of: OFF, CFRQ, RFLV, LFGF, LFGL, INTF1, INTF2, INTF3, INTF4, INTF5, INTF6, HOP or OFF)
Allowed suffices : None
Default suffix : None

Examples:
```
:SWEEP:MODE SNGL;TYPE CFRQ
:SWEEP:MODE CONT;TYPE INTF4
```

SWEEP? Prepares message containing information on Sweep Mode, Type and Marker status in the following format:

:SWEEP:MODE <mode>;TYPE <type>;<status>

where: <mode> is a program mnemonic representing the sweep mode selected, <Type> is a program mnemonic representing the sweep type selected and <status> is a program mnemonic indicating whether the Marker output is ON or OFF.

Examples:
```
:SWEEP:MODE CONT;TYPE CFRQ;MKROFF
:SWEEP:TYPE HOP:MODE SNGL
```

SWEEP CONTROL

SWEEP [not used alone]
- **:GO** Commence Sweep
- **:CALC** Initiate Pre-calculation
- **:HALT** Pause Sweep
- **:CONT** Continue Sweep
- **:RESET** Reset sweep to Start Value
- **:XFER** Transfer Paused Value to Main Parameter
- **:UP** Go UP one sweep step while paused
- **:DN** Go DOWN one sweep step while paused

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
SWEEP:GO
SWEEP:RESET
```

FREQUENCY HOPPING

HOPSEQ Enter frequency hopping sequence

Data type : Decimal Numeric Program data (can be multiple)
Allowed suffices : None
Default suffix : None

Examples:
```
HOPSEQ 56, 72, 0, 4, 99, 72
HOPSEQ 255, 0, 4, 17, 23, 64, 72
```

HOPSEQ? Returns a value 0-1024 indicating the number of steps in the Frequency Hopping Sequence.

MISCELLANEOUS COMMANDS

IMODE Select Instrument Mode

Data type : Character Program Data (either NORMAL for signal generator operation or SWEEPER for swept operation)
Allowed suffices : None
Default suffix : None

RPPR Reset reverse power protection trip

Data type : None
Allowed suffices : None
Default suffix : None

FSTD Select internal or external frequency standard

Data type : Character program data (any one of INT1, INT5, INT10, EXT1, EXT5 or EXT10)
Allowed suffices : None
Default suffix : None

Examples:
```
INT10
EXT5
```

FSTD? Prepares message containing information on frequency standard selection in the format:

:FSTD <char>

Example:
```
:FSTD EXT10
```

BLANK Blank or unblank various parts of the display. The number sent after the command determines the action to be taken as follows:

0 blank or unblank the Carrier Frequency display
1 blank or unblank the RF Level display
2 blank or unblank the Modulation Frequency display
3 blank or unblank the Modulation display
4 blank all displays

Data type : Decimal Numeric Program Data (any one of 0, 1, 2, 3 or 4)
Allowed suffices : None
Default suffix : None

Examples:
```
BLANK 0
BLANK 4
```

BACKL [not used alone]
:ON Backlighting On
:OFF Backlighting Off

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
BACKL:ON
BACKL:OFF
```

TIME?

Prepares message containing information on current real time clock time setting in the format:

<HH:MM>

where: <HH:MM> is string program data representing the time in hours and minutes using the 24 hour clock notation.

Example:
```
"17:55"
```

DATE?

Prepares message containing information on current real time clock date setting in the format:

<YYYY-MM-DD>

where: <YYYY-MM-DD> is string program data representing the date in ISO notation (year number, month number, day number).

Example:
```
"1990-04-01"
```

OPER?

Prepares message containing information on total operating hours in the following format:

<nr2>

Example:
```
1453.
```

ELAPSED?

Prepares message containing information on elapsed operating hours since last reset in the following format:

<nr2>

Example:
```
454.5
```

ERROR?

Prepares message containing the number of the next error in the error queue in the following format:

<nr1>

The numeric value returned is either that of the next error number or 0 if the queue is empty or 255 if the queue is full

Example: `37`

DEFTRG

Set Device Trigger Function (action on receipt of *TRG)

Data type : Character Program Data (any one of: SEQT, FLSWP, SSSWP or VOID)
Allowed suffices : None
Default suffix : None

EXTTRG

Set External Trigger Function (action on Low signal being applied to External Trigger Socket).

Data type : Character Program Data (any one of: SEQT, FLSWP, SSSWP, MEMUP, MEMDN or VOID)
Allowed suffices : None
Default suffix : None

Examples:
```
DEFTRG SEQT
EXTTRG MEMUP
```

KLOCK

Disables keyboard entry except RPP Reset and Go to Local

Data type : None
Allowed suffices : None
Default suffix : None

KUNLOCK

Enables keyboard entry

Data type : None
Allowed suffices : None
Default suffix : None

THE STATUS BYTE

The Status Byte provides information about events and conditions within the instrument. It may be read by a conventional Serial Poll or its value obtained as a response to the *STB? query. Bits 0 to 5 and bit 7 are each single bit Summary Messages which may be of two types (or not used at all).

(i) Query Status - a '1' indicates that an associated Queue is non-empty and has data available to be read.

(ii) Status Register Summary - reports the occurrence of an enabled event monitored by a Status Register Structure.

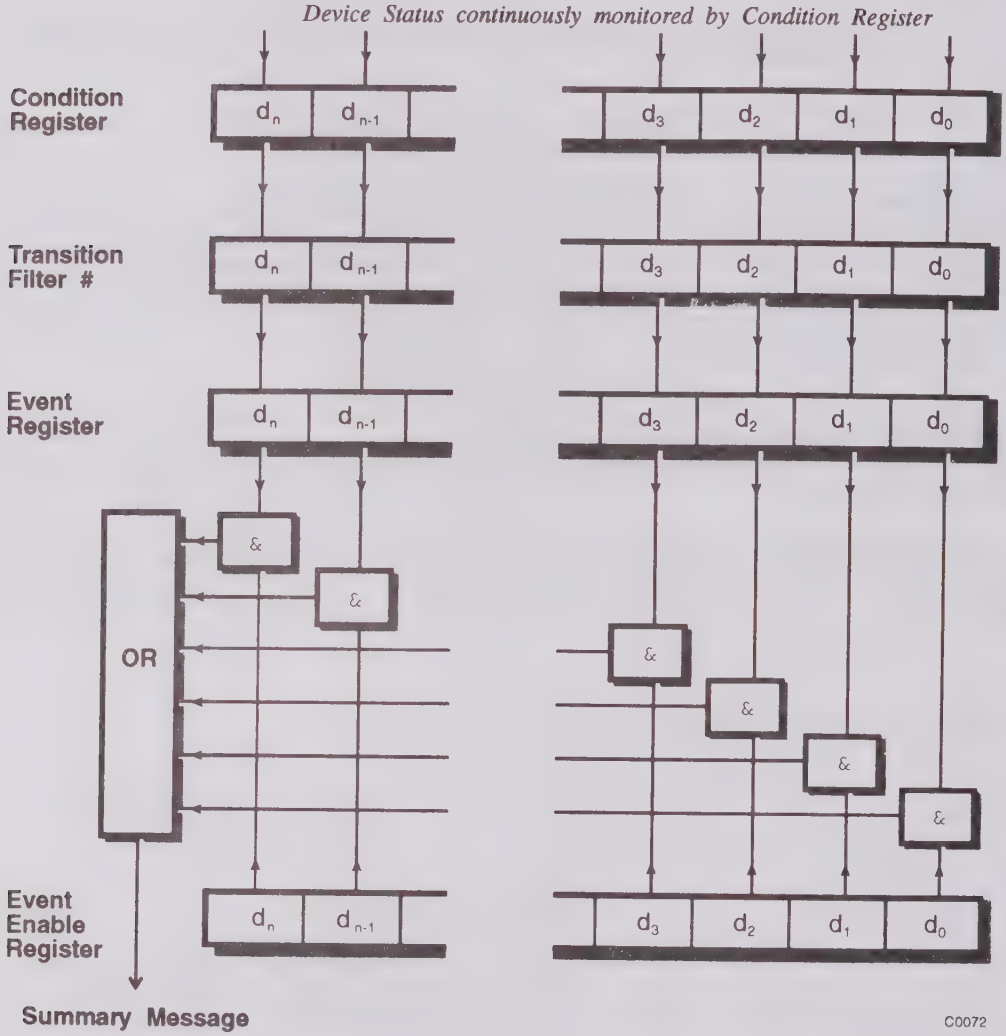
The Service Request Enable Register determines which of the bits can generate an SRQ, this register may be set by *SRE or read by *SRE?. If the bitwise -AND of the Status Byte and the Enable Register is non-zero the Flag Master Summary Status (<mss>) is True. Bit 6 of the Status byte value read by *STB? holds <mss>. However bit 6 of the Status Byte when Serial Polled is the Request For Service bit used to determine which device on the Bus has asserted SRQ, and is cleared by a Serial Poll.

The IEEE 488.2 Standard defines bit 4 as Message Available (<mav>), the Queue Summary for the Output Buffer, indicating whether any part of a Response Messages is available to be read. Bit 5 is the Event Summary Bit (<esb>), the Summary Message from the Standard Event Status Register.

In 2030 series, bit 7 is a Queue Summary for the Error Queue. Bits 1, 2, and 3 are Status summaries for the Instrument Status, Coupling Status and Hardware Status Registers. Bit 0 is unused.

STATUS DATA STRUCTURE - REGISTER MODEL

Below is a generalised model of the Register Set which funnels the monitored data into a single summary bit to set the appropriate bit in the Status Byte.



Notes...

The Device Status is continuously monitored by the Condition Register. If a Query to read a Condition Register is provided, the Response represents the Status of the instrument at the moment the Response is generated. A Condition Register cannot be written to.

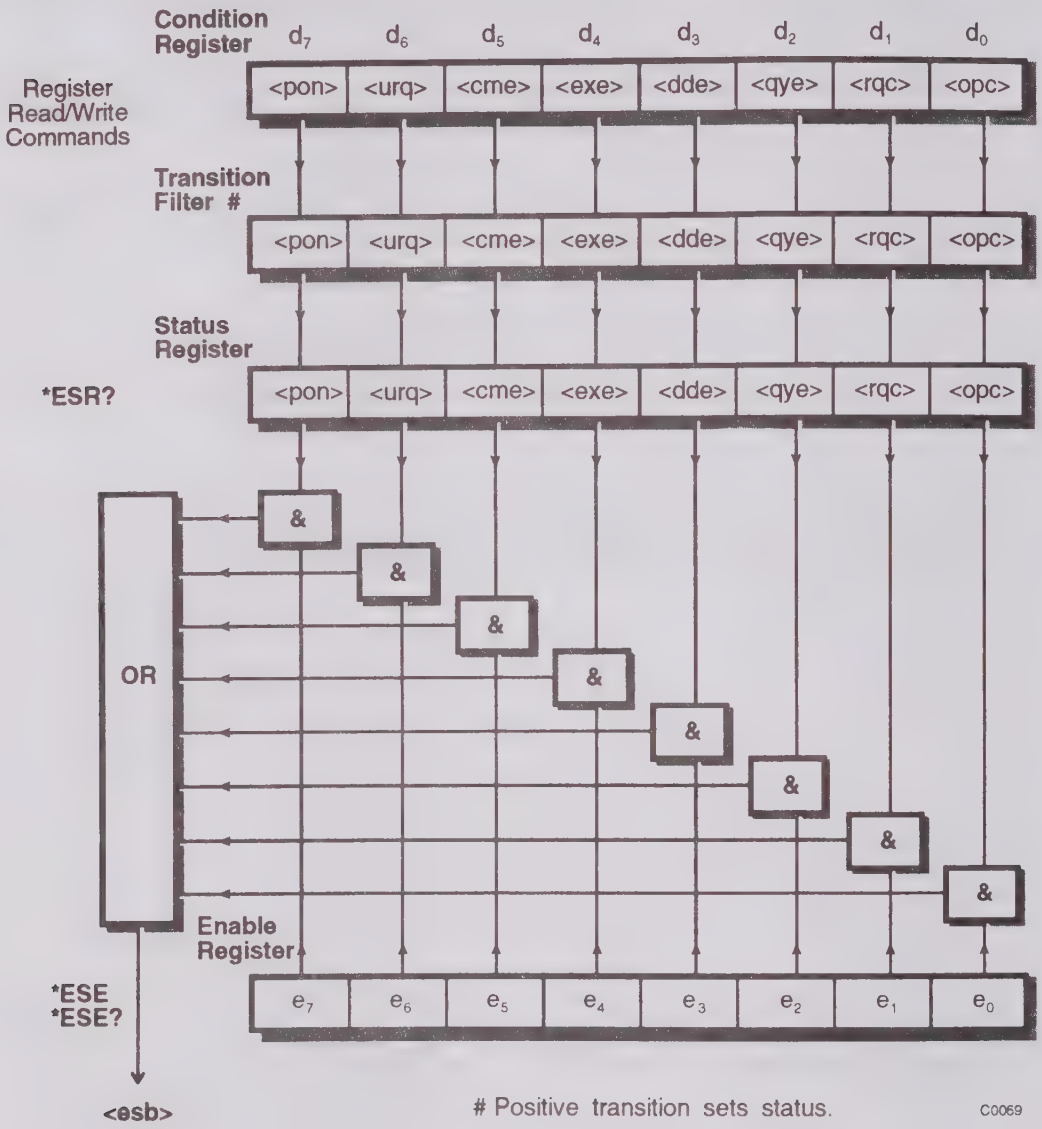
The Transition Filter determines which transition of the Condition Register data bits will set the corresponding bit in the Event Register. Either positive-going, negative-going or both transitions can set bits in an Event Register. But in the 2030 series the Transition Filters are pre-set as either Positive or Negative, as described in the following pages.

The bits in an Event Register are "latched". Once set they remain set, regardless of subsequent changes in the associated condition bit until the Event Register is cleared by being read or by the *CLS common command. Once cleared, an Event Register bit will only be set again if the appropriate change in the Condition bit occurs.

The Event Enable Register may be both written to and read from. It is bitwise AND-ed with the Event Register and if the result is non-zero the Summary Message is true, otherwise the Summary Message is false. Enable Registers are not affected by *CLS but are however clear at power-on.

STANDARD EVENT REGISTERS

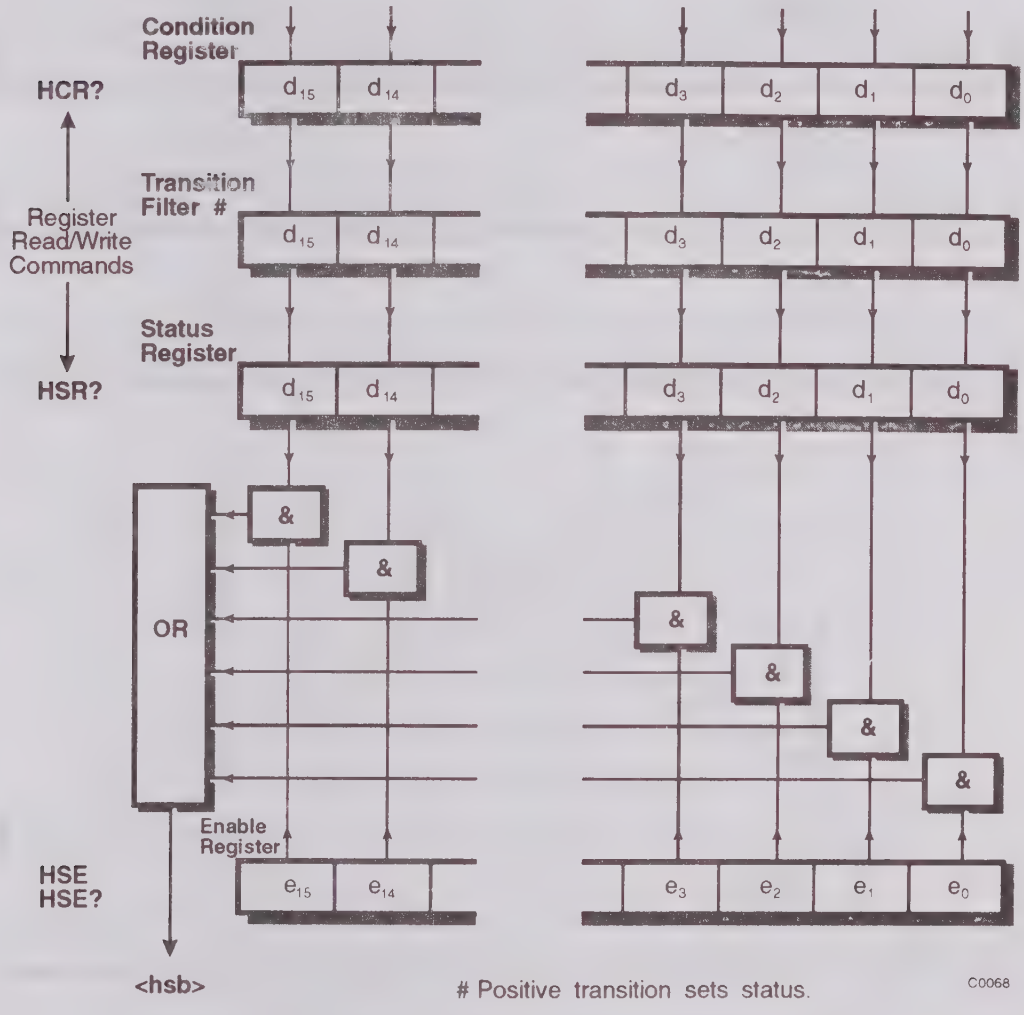
This Register is defined by IEEE 488.2 and each bit has the meaning shown below:-



<pon>	power on
<urq>	user request - not implemented in this product
<cme>	command error
<exe>	execution error
<dde>	device dependent error
<qye>	query error
<rqc>	request control - not implemented in this product
<opc>	operation complete - set in response to the *OPC command for synchronisation.
<esb>	standard event register summary bit

HARDWARE EVENT REGISTERS

This is a device dependant register and the bits have meanings as shown in the list at the bottom of the page.

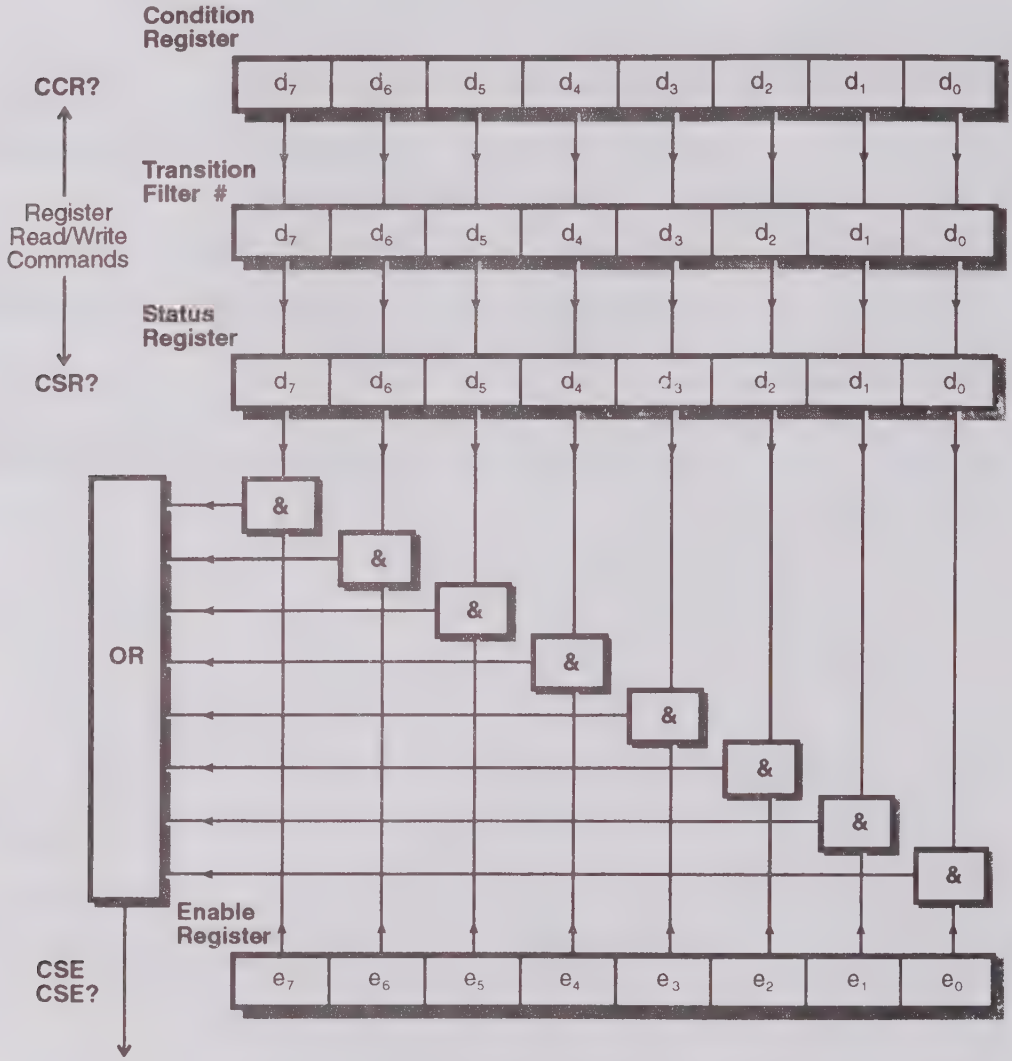


d_0	reverse power protection tripped	d_8	not used
d_1	fractional-n system out-of-lock	d_9	not used
d_2	vcxo out-of-lock	d_{10}	not used
d_3	frequency standard missing	d_{11}	not used
d_4	external mod 1 alc loop signal too low	d_{12}	not used
d_5	external mod 1 alc loop signal too high	d_{13}	not used
d_6	external mod 2 alc loop signal too low	d_{14}	not used
d_7	external mod 2 alc loop signal too high	d_{15}	not used

<hsb> hardware event register summary bit

COUPLING EVENT REGISTERS

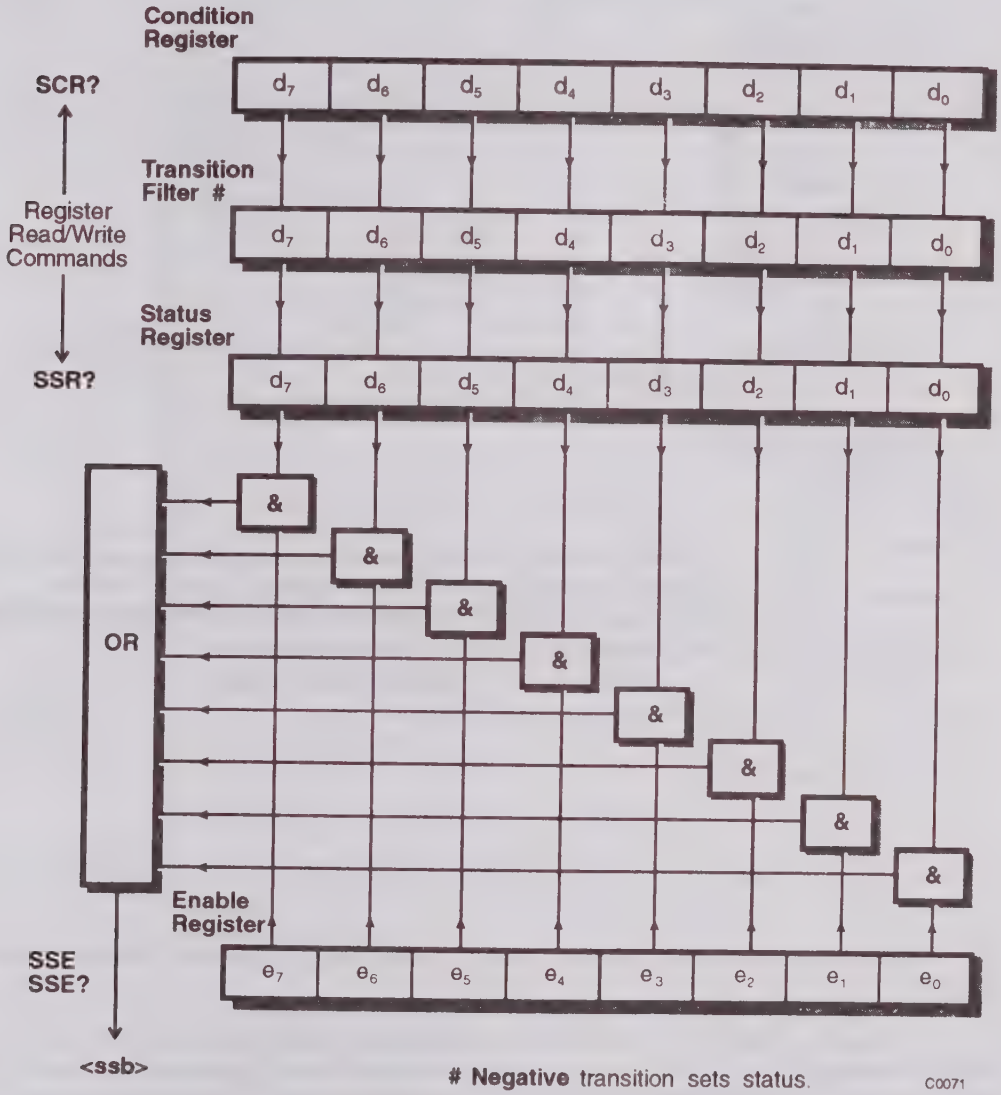
This is a device dependant Register and the bits have meanings as shown in the list at the bottom of the page.



d_7	rf level restricted by requested am
d_6	fm restricted by requested carrier frequency
d_5	widebandfm restricted by requested carrier frequency
d_4	am2 depth restricted by requested am1 depth
d_3	fm2 deviation restricted by requested fm1 deviation
d_2	pm2 deviation restricted by requested pm1 deviation
d_1	number of sweep steps restricted by other parameters
d_0	not used
<csb>	coupling event register summary bit

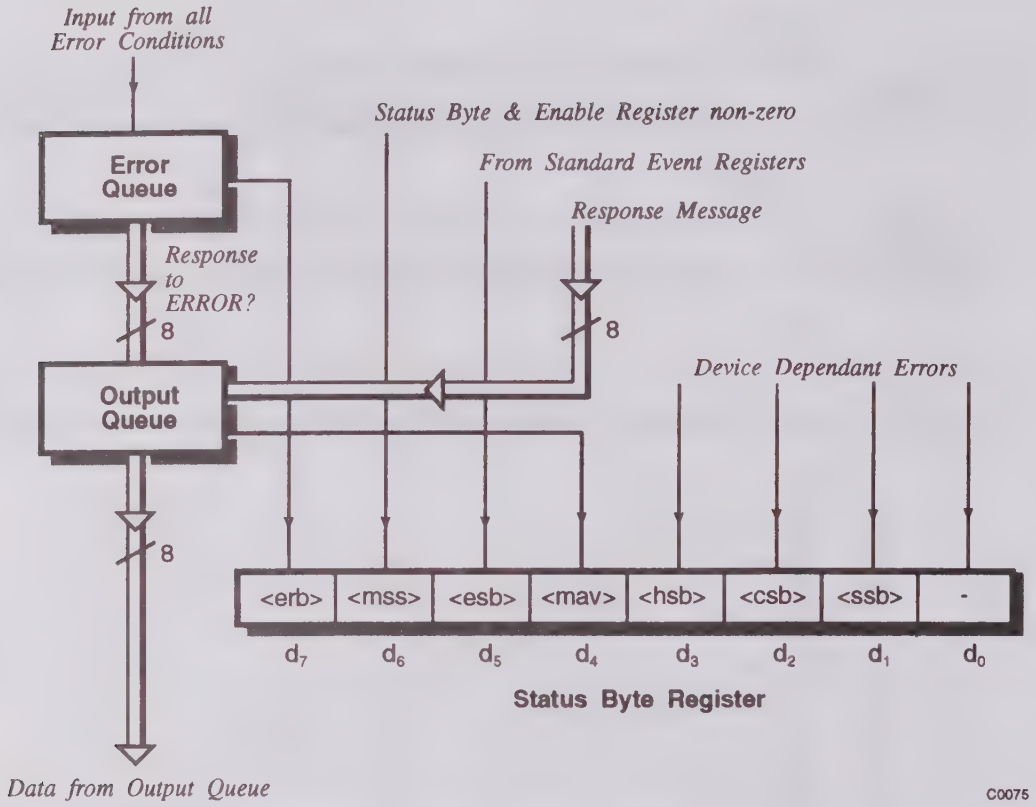
INSTRUMENT EVENT REGISTERS

This is a device dependant Register and the bits have meanings as shown in the list at the bottom of the page.



	Condition (*SCR?)	Event Status (*SSR?)
d	sweep in progress	end of sweep
d_0	sending tones	tones sent
d_1	selfcal in progress	selfcal completed
d_2	dc fm null in progress	dc fm null completed
d_3	not used	not used
d_4	not used	not used
d_5	not used	not used
d_6	not used	not used
d_7	not used	not used
<ssb>	instrument event register summary bit	

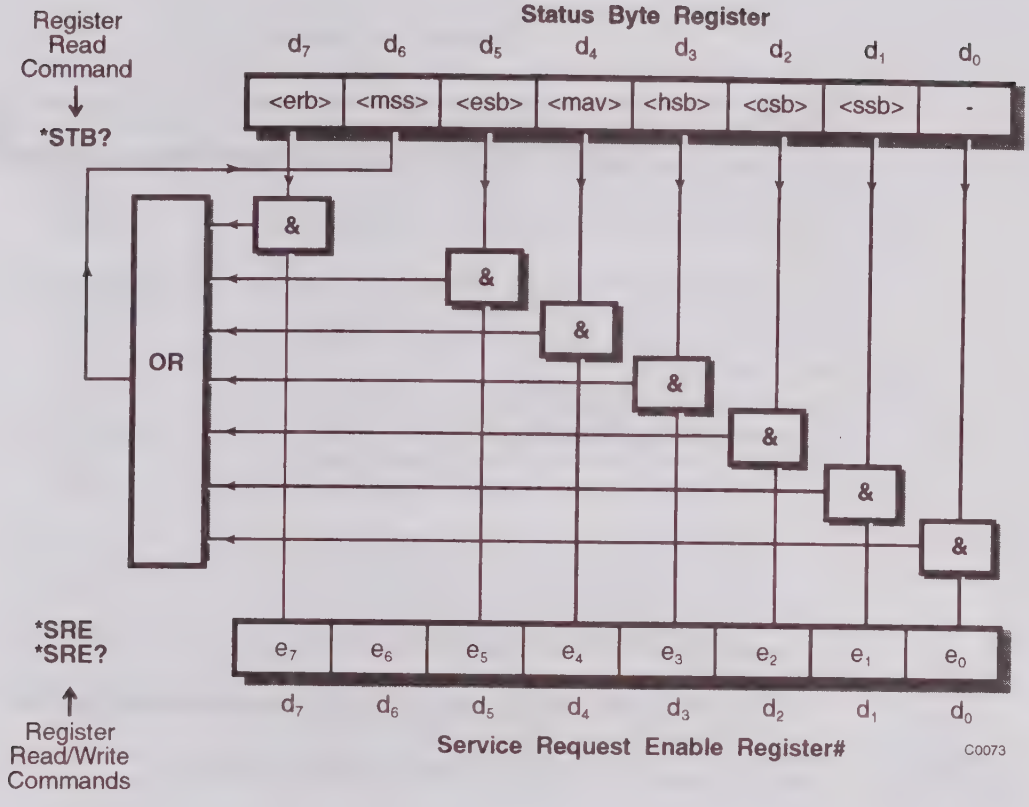
QUEUE FLAG DETAILS



The <mav> status bit is set when one or more bytes are available to be read from the Output Queue.

The <erb> status bit is set when one or more errors are present in the Error Queue. The ERROR? query will place a nr1 response message in the Output Queue representing the Error at the head of the queue, if the queue is empty then this message will be 0.

STATUS BYTE WHEN READ BY *STB?



Bit 6 in this register ignores data sent by ***SRE** and always returns 0 in response to ***SRE?**

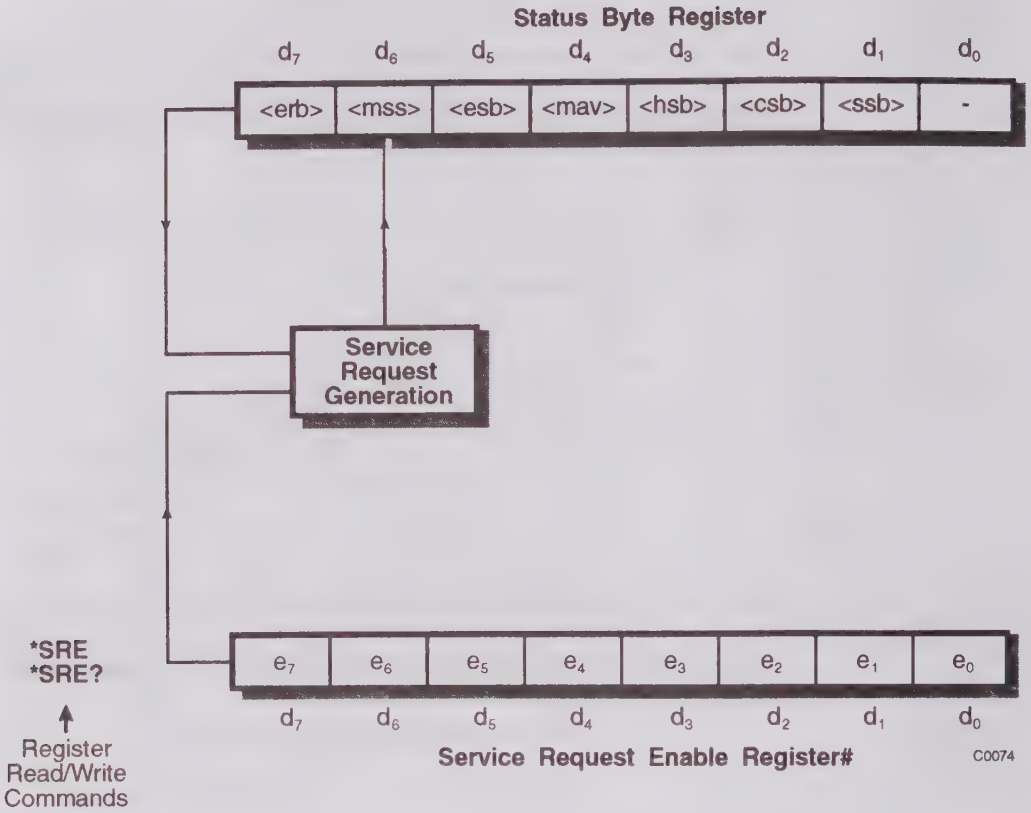
<rqs>, <esb> and <mav> are defined in IEEE 488.2

<erb> is a device defined queue summary bit indicating that the error queue is non-empty.
<mss> is true when (Status Byte) AND (Enable register) > 0.
<esb> is the standard event register summary bit.
<mav> is 'message available' indicating that the output queue is non-empty.
<hsb> is 'hardware status' summary bit
<csb> is 'coupling status' summary bit
<ssb> is 'instrument status' summary bit

Note...

The Status Byte Register is Not cleared by the *STB? query.

STATUS BYTE WHEN READ BY SERIAL POLL



Bit 6 in this register ignores data sent by ***SRE** and always returns 0 in response to ***SRE?**

<erb> is a device defined queue summary bit indicating that the error queue is non-empty.
<rqs> is set by a request for service and is cleared by the poll.
<esb> is the standard event register summary bit.
<mav> is 'message available' indicating that the output queue is non-empty.
<hsb> is 'hardware status' summary bit
<csb> is 'coupling status' summary bit
<ssb> is 'instrument status' summary bit

<rqs>, <esb> and <mav> are defined in IEEE 488.2

<rqs> (request for service) will produce an SRQ at the controller. It is set by a change to either the Status Byte or the Service Enable Register that results in a New Reason for Service. It is cleared when <mss> goes FALSE (i.e. no reason for service) or by Serial Poll.

SUMMARY OF STATUS REPORTING COMMANDS AND QUERIES

***CLS**	Clears Status Registers and the Error Queue
***ESE<nrf>**	Writes to Standard Event Enable Register
***ESE?**	Reads from Standard Event Enable Register
***ESR?**	Reads from Standard Event Status Register
***SRE<nrf>**	Writes to Service Request Enable Register
***SRE?**	Reads from Service Request Enable Register
***STB?**	Reads from Status Byte Register
CCR?	Reads from Coupling Condition Register
CSE<nrf>	Writes to Coupling Status Enable Register
CSE?	Reads from Coupling Status Enable Register
CSR?	Reads from Coupling Status Register
HCR?	Reads from Hardware Condition Register
HSE<nrf>	Writes to Hardware Status Enable Register
HSE?	Reads from Hardware Status Enable Register
HSR?	Reads from Hardware Status Register
SCR?	Reads from Instrument Condition Register
SSE<nrf>	Writes to Instrument State Enable Register
SSE?	Reads from Instrument State Enable Register
SSR?	Reads from Instrument State Status Register
<nrf>	Decimal Numeric Program Data

All of the above queries respond with a nr1 numeric format.

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Chapter 4-1
BRIEF TECHNICAL DESCRIPTION

INTRODUCTION

The 2030 series signal generators cover a wide range of frequencies from 10 kHz to 1.35 GHz (2030), 10 kHz to 2.7 GHz (2031) and 10 kHz to 5.4 GHz (2032). Output levels from -144 or -138 dBm to +13 dBm (+19 dBm on 2030 with Option 003 fitted) are available. The simplified block schematic diagram for the instrument is shown in Fig. 4-1.

MODULATION

The carrier frequency can be frequency, phase or amplitude modulated from internal or external modulation sources. A maximum of four modulation channels can be made available by the use of the internal oscillator and a second optional internal oscillator together with two external modulation signals applied to the EXT MOD 1 INPUT and EXT MOD 2 INPUT connectors on the front panel.

FREQUENCY GENERATION

Four voltage controlled oscillators (VCOs) covering the frequency range 675 to 1350 MHz are phase locked to a 10 MHz oven controlled crystal oscillator using a fractional-N synthesizer system. Additional frequency coverage is achieved by means of frequency division or multiplication. Low frequencies are generated by a beat frequency oscillator (BFO) system.

DISPLAY

The display is a high definition dot matrix liquid crystal panel with backlighting to cater for variations in ambient light conditions. The display can be adjusted for both contrast and brightness.

CONTROL

The 2030 series are menu driven instruments. Main menus are displayed by the use of hard keys, and parameters are changed by means of soft keys which change as the menu changes. Internal control of the instruments is achieved by a microprocessor which receives data from the various controls and sends instructions via an internal 8-bit data bus to the signal processing circuits.

The instruments can also be controlled by the built in general purpose interface bus (GPIB). This facility enables the instruments to be used both as manually operated bench mounted instruments or as part of a fully automated test system.

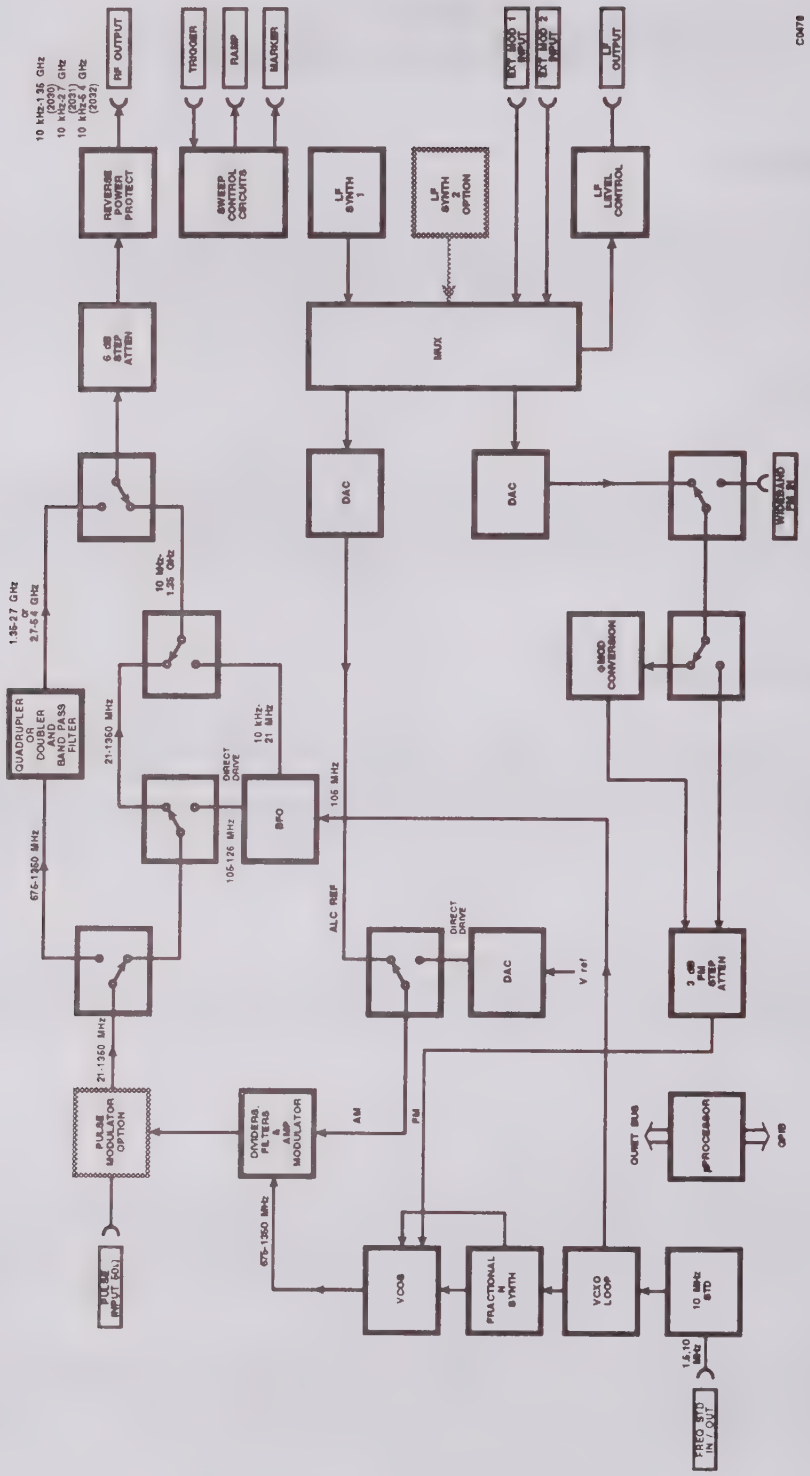

Fig. 4-1-1 Block schematic diagram

Chapter 5-1
ACCEPTANCE TESTING

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INTRODUCTION

Test procedures described in this chapter may be simplified and of restricted range compared with those that relate to the generally more comprehensive factory test facilities which are necessary to demonstrate complete compliance with the specifications.

Performance limits quoted are for guidance and should not be taken as guaranteed performance specifications unless they are also quoted under 'Performance Data' in Chapter 1.

When making tests to verify that the instrument meets the stated performance limits, always allow for the uncertainty of the test equipment.

For those signal generators with options fitted, the appendixes at the end of this Chapter and the Annexes at the end of this manual must be referred to.

RECOMMENDED TEST EQUIPMENT

The test equipment recommended for acceptance testing is shown in Table 5-1-1. Alternative equipment may be used provided it complies with the stated minimum specification.

TABLE 5-1-1 RECOMMENDED TEST EQUIPMENT

Description	Minimum specification	Example
Power meter	±0.1 dB from 10 kHz to 5.4 GHz	Marconi 6960A and 6910 or 6912 sensor
Measuring receiver	0 dBm to -127 dBm; 2.5 to 1300 MHz	HP8902A and 11722A sensor and 11793A down converter#
Signal generator	8 dBm from 32.5 MHz to 5.4 GHz	Marconi 2032
Frequency counter	10 Hz to 5.4 GHz	Marconi 2440
Audio analyzer	Capable of measuring THD below 0.03%m from 50 Hz to 20 kHz. Capable of measuring 0.5 mV ±3% and levels at 10 Hz	HP8903B or Rhode & Schwarz UPA3
Digital multimeter	DC to 500 kHz, 1 mV to 5 V	Datron 1061A
Modulation meter	AM, FM and ΦM. 1.5 MHz to 1 GHz. Accuracy better than 1.1%. Modulation freqs from 30 Hz to 50 kHz. Capable of measuring Residual FM less than 7 Hz.	Marconi 2305 plus distortion option*
Spectrum analyzer	10 kHz to 16.2 GHz Capable of measuring less than -70 dBm.	Marconi 2386
Function generator	DC to 500 kHz sine ±0.6 dB flatness	HP3325B

* The distortion option of the 2305 Modulation Meter allows modulation distortion tests to be carried out with greater ease. If a 2305 with a distortion option is not available, the Audio Analyzer may be connected to the Modulation Meter LF output and set to measure distortion.

If receiver and down converter are not available, an alternative procedure to ensure attenuator pad accuracy using a power meter is given.

TEST PROCEDURES

Before each test, it is recommended that the UUT is reset to its switch-on conditions which are as follows:

Carrier freq	1.35 GHz (2030), 2.7 GHz (2031), 5.4 GHz (2032)
RF level	-138 dBm (2030), -144 dBm (2031, 2032)
FM	0 Hz ON
Single modulation mode	
Modulation	ENABLED

RF OUTPUT

SPECIFICATION	
Level range:	-127 dBm to +13 dBm (usable to -144 dBm)
Accuracy:	**(2030, 2031 and 2032)** ±1 dB from 10 kHz to 1.35 GHz at levels >-127 dBm ±0.65 dB from 10 kHz to 1.35 GHz at levels >0 dBm **(2031 and 2032)** ±2 dB from 1.35 GHz to 2.7 GHz at levels >-127 dBm ±1 dB from 1.35 GHz to 2.7 GHz at levels >0 dBm **(2032 only)** ±3 dB from 2.7 GHz to 5.4 GHz at levels >-100 dBm ±2 dB from 2.7 GHz to 5.4 GHz at levels >-50 dBm ±1.5 dB from 2.7 GHz to 5.4 GHz at levels >0 dBm

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
RF power meter	±0.1 dB from 30 kHz to 2.7 GHz	Marconi 6960A and 6910 or 6912 sensor
Measuring receiver	0 dBm to –127 dBm; 2.5 MHz to 1300 MHz	HP 8902A and 11722A sensor and 11793A down converter
Signal generator	8 dBm from 32.5 MHz to 5.4 GHz	Marconi 2032

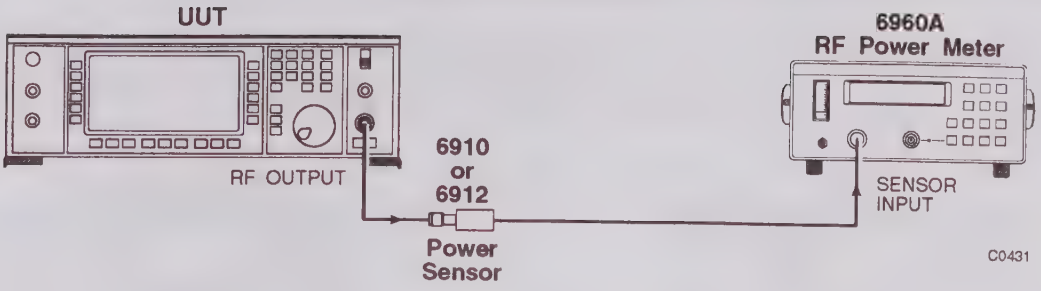

Fig. 5-1-1 RF output test set-up

(1) Connect the test equipment as shown in Fig. 5-1-1.

(2) Set the UUT to *[RF level]* 0 dBm, *[Carrier freq.]* 30 kHz.

(3) Check that the output level is within specification at the frequencies shown in Table 5-1-2.

When checking a 2032 signal generator, the 6912 sensor must be replaced with 6910 sensor for frequencies above 2700 MHz.

(4) Set the UUT RF output to 7 dBm and repeat (3) above.

(5) Set the UUT RF output to 13 dBm and repeat (3) above.

TABLE 5-1-2 FREQUENCY SETTINGS FOR OUTPUT LEVELS

FREQUENCY (MHz)				
(2030/1/2)	1125	2025	2925	4425
0.03	1275	2175	3075	4575
0.1	1350	2325	3225	4725
75		2475	3375	4875
225	**(2031/2)**	2625	3525	5025
375	1351	2700	3675	5175
525	1425		3825	5325
675	1575	**(2032)**	3975	5400
825	1725	2701	4125	
975	1875	2775	4275	

ALC linearity

(1) Connect the test equipment as shown in Fig. 5-1-1.

(2) Set the UUT to *[RF level]* 0 dBm, *[Carrier freq.]* 2.5 MHz.

(3) Increment the RF output of the UUT in 1 dB steps up to 12 dBm and in 0.1 dBm steps up to 13 dBm, measuring the RF level at each step. Check that the RF output level variation is within ±0.1 dB.

(4) Set the UUT carrier frequency to 500 MHz and repeat (3) above.

(5) Set the UUT carrier frequency to 2.7 GHz and repeat (3) above.

(6) Replace the 6912 sensor with the 6910 sensor, set the UUT carrier frequency to 5.4 GHz and repeat (3) above.

Attenuator accuracy

The following test will confirm that the attenuator performs to the published performance specification. In the event of the receiver/down converter not being available, an alternative method to functionally test the attenuator is also suggested (see 'Alternative attenuator functional check' below).

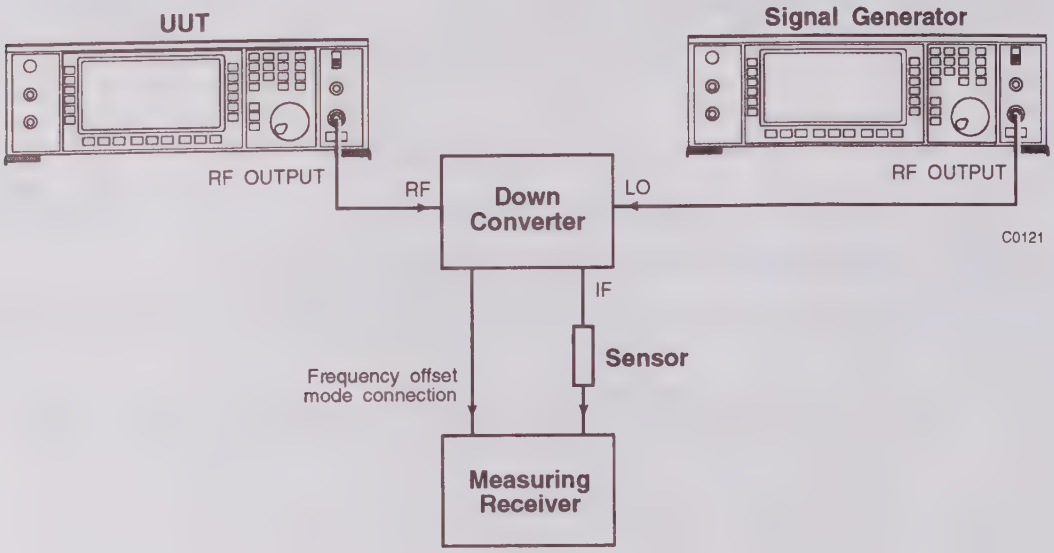

Fig. 5-1-2 Attenuator accuracy test set-up

(1) Connect the test equipment as shown in Fig. 5-1-2.

(2) Set the UUT to *[RF level]* 0 dBm, *[Carrier freq.]* 2.5 MHz.

(3) Tune the receiver to 2.5 MHz and measure the RF level.

(4) Set the UUT to *[RF level]* -6.1 dBm and measure the RF level.

(5) Decrement the output of the UUT in 6 dB steps down to an RF level of -120.1 dBm measuring the RF level at each step. Check that the measured level is within specification.

(6) Repeat (2) to (5) at the frequencies given in Table 5-1-3.

(7) Set the local oscillator to +8 dBm at the frequencies indicated in brackets in Table 5-1-3.

TABLE 5-1-3 ATTENUATOR FREQUENCY SETTINGS

Frequency (MHz)		
2030/1/2	*2031/2	**2032
2.5	1725 (1662)	2775 (2712)
31	2700 (2637)	4125 (4062)
325		5400 (5337)
1125		
1275		

*At frequencies above 1300 MHz the down converter will automatically be enabled.
**At frequencies above 2700 MHz it is only necessary to test down to -96.1 dBm (determined by 8902 accuracy).

The frequency of the local oscillator will have to be entered on the receiver followed by the test frequency. This will automatically set the receiver to the required IF frequency.

Alternative attenuator functional check

(1) Connect the test equipment as shown in Fig. 5-1-1.

(2) Set the UUT to *[Carrier freq.]* 1.35 GHz, *[RF level]* 13 dBm.

(3) Set a reference on the power meter.

(4) Using the latch poke facility on the UUT, select each attenuator pad individually as follows:

[UTIL] *[Utils. Menu 2] [Latch Data]* 95 [enter]
[Decimal/Binary]

The binary latch data will now appear in the bottom right-hand side of the display.

(5) By using the *[Toggle Bit]* and the *[Cursor Left] [Cursor Right]* soft keys, select each attenuator pad in turn which should give the nominal readings on the power meter in the following sequence:

-24 dB -36 dB -6 dB -12 dB -24 dB -36 dB

Note that no software correction is applied to the attenuator when performing this test.

CARRIER FREQUENCY ACCURACY

SPECIFICATION	
Frequency range:	10 kHz to 1.35 GHz (2030) 10 kHz to 2.7 GHz (2031) 10 kHz to 5.4 GHz (2032)
Accuracy:	Determined by the frequency standard accuracy
Resolution:	0.1 Hz

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Frequency counter	10 kHz to 5.4 GHz	Marconi 2440

TEST PROCEDURES

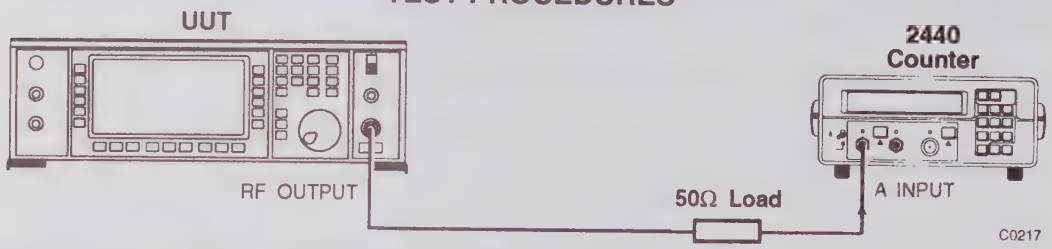

Fig. 5-1-3 Carrier frequency accuracy test set-up

(1) Connect the test equipment as shown in Fig. 5-1-3.

(2) Set the UUT to *[RF level]* 0 dBm, *[Carrier freq.]* 10 kHz.

(3) Referring to Table 5-1-4, check that the carrier frequencies can be selected correctly and are within specification. It will be necessary to disconnect the 50 ohm load and reconnect the UUT RF OUTPUT to the B input and C input where indicated.

TABLE 5-1-4 CARRIER FREQUENCIES

Carrier Frequencies (Hz)

(2030/1/2) A Input	B Input		(2032)
		805,306,368.0	2,700,001,000.0
		952,945,868.8	5,400,000,000.0
10,000.0	168,749,999.9	959,656,755.2	
4,226,750.0	337,499,999.9	1,134,139,801.6	
8,443,500.0	572,662,306.1	1,140,850,688.0	
12,660,250.0		1,145,324,612.2	
16,887,000.0	C Input	1,348,888,166.4	
21,093,749.9			
21,039,750.0	674,999,999.9	(2031/2)	
42,187,499.9	677,799,526.4	1,350,001,000.0	
84,374,999.9	798,595,481.6	2,700,000,000.0	

MODULATION OSCILLATOR

SPECIFICATION	
Frequency range:	0.1 Hz to 500 kHz
Accuracy:	Equal to the frequency standard accuracy
Resolution:	0.1 Hz
Distortion:	Less than 0.1% THD at frequencies up to 20 kHz sine wave mode

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Frequency counter	10 Hz to 500 kHz	Marconi 2440
Audio analyzer	Capable of measuring down to 0.03% THD from 100 Hz to 20 kHz	HP 8903B Rhode & Schwarz UPA 3

TEST PROCEDURES

Modulation oscillator frequencies

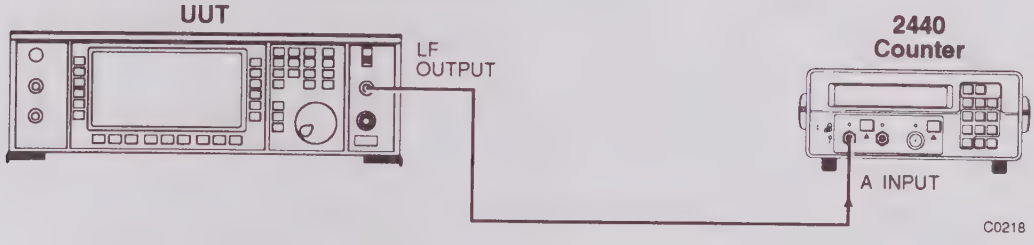

Fig. 5-1-4 Modulation oscillator frequencies test set-up

(1) Connect the test equipment as shown in Fig. 5-1-4.

(2) Set the UUT to *[Source Freq: F4]* 10 Hz.

(3) Referring to Table 5-1-5, check that the oscillator frequencies can be selected correctly and are within specification.

TABLE 5-1-5 MODULATION OSCILLATOR FREQUENCIES

Modulation oscillator frequencies (Hz)	
10.00	279,620.20
139,810.10	500,000.00

Modulation oscillator distortion

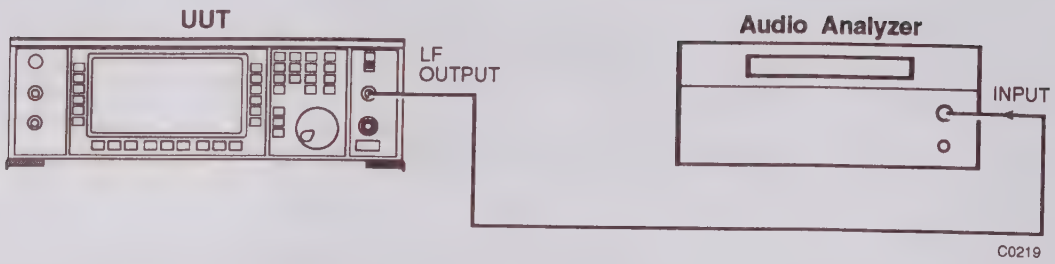

Fig. 5-1-5 Modulation oscillator distortion test set-up

(1) Connect the test equipment as shown in Fig. 5-1-5.

(2) Set the UUT to *[Source Freq: F4]* 100 Hz.

(3) Check that the distortion measured on the audio analyzer at the frequencies indicated in Table 5-1-6 is less than 0.1%.

TABLE 5-1-6 DISTORTION FREQUENCY SETTINGS

Modulation oscillator frequencies

100 Hz	10 kHz
1 kHz	20 kHz

LF OUTPUT

SPECIFICATION	
Level accuracy:	±5% for levels above 50 mV ±10% for levels from 500 µV to 50 mV (With a load impedance >10 kΩ)
Frequency response:	Typically better than 1 dB from 0.1 Hz to 300 kHz

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Digital multimeter	DC to 300 kHz, 1 mV to 5 V	Datron 1061A
Audio analyzer	Capable of measuring 0.5 mV ±3% and levels at 10 Hz	HP 8903B Rhode & Schwarz UPA3

TEST PROCEDURES

Level accuracy

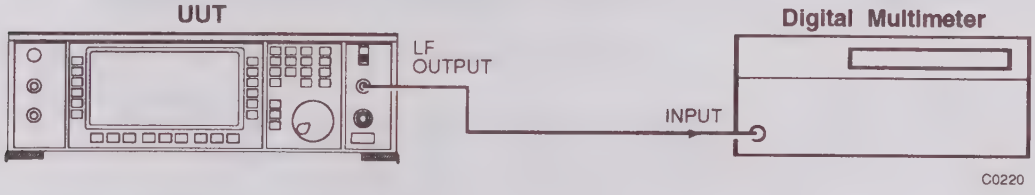

Fig. 5-1-6 Level accuracy test set-up

(1) Connect the test equipment as shown in Fig. 5-1-6.

(2) Set the UUT to give an LF output of 5 V at 1 kHz as follows:

[LF] *[LF Gen] [LF Freq]* 1 kHz *[LF Level]* 5 V

(3) The level measured on the digital multimeter should read 5 V ±0.25 V.

(4) Check the LF output of the UUT at the levels indicated in Table 5-1-7. Check that the measured levels are within specification.

TABLE 5-1-7 LEVEL ACCURACY OUTPUT LEVELS

LF output levels (V)		
5.0000	0.1000	0.0050
2.0000	0.0500	0.0020
1.0000	0.0200	0.0010
0.5000	0.0100	*0.0005
0.2000		

*For the last measurement it will be necessary to use the audio analyzer. Connect the test equipment as shown in Fig. 5-1-5.

Frequency response

(1) Connect the test equipment as shown in Fig. 5-1-6.

(2) Set the UUT to give an LF output of 1 V at 1 kHz on the first modulation oscillator (see 'Level accuracy' (2) above).

(3) Reference this level on the digital voltmeter using the dB relative function.

(4) Set the modulation oscillator to the frequencies given in Table 5-1-8 measuring the difference from the reference in (3) above which should be less than 1 dB.

TABLE 5-1-8 FREQUENCY RESPONSE TEST FREQUENCIES

Test frequencies		
*10 Hz	1 kHz ref	70 kHz
*30 Hz	10 kHz	100 kHz
*100 Hz	30 kHz	300 kHz

* For these measurements it will be necessary to use the audio analyzer. Connect the test equipment as shown in Fig. 5-1-5, referencing the audio analyzer at 1 kHz.

EXTERNAL MODULATION

SPECIFICATION	
	With ALC off, the modulation is calibrated for an input level of 1.0 V PD RMS With ALC on, the modulation is calibrated for input levels between 0.7 V and 1.4 V PD RMS
Distortion:	Less than 0.1% from 50 Hz to 20 kHz at 1 V RMS
Flatness:	Typical 1 dB bandwidth, 10 Hz to 500 kHz

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Function generator	10 Hz to 500 kHz sine wave ±0.6 dB flatness	HP 3325B
Digital multimeter	10 Hz to 500 kHz	Datron 1061A
Audio analyzer	Capable of measuring THD down to 0.03% from 50 Hz to 20 kHz	HP 8903B Rhode & Schwarz UPA3

Mod ALC on flatness

TEST PROCEDURES

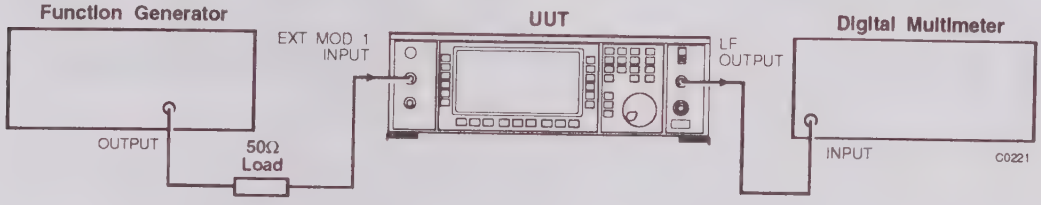

Fig. 5-1-7 External modulation test set-up

Mod input 1

(1) Connect the test equipment as shown in Fig. 5-1-7.

(2) Set the function generator to 1 V RMS sine wave output at a frequency of 1 kHz.

(3) Set the UUT to EXT MOD 1 INPUT with ALC ON as follows:

PRESSER [LF MONITOR] SI NECESSAIRE

[LF] *[Mod Drive]*
[SIG GEN] *[FM]* 90 kHz *[Select Source]*
[Select External] [Ext1 ALC Coupling] **[SIG GEN]**

(4) Set the digital multimeter to read dB and measure and record this value.

(5) Set the function generator to the frequencies given in Table 5-1-9 and measure the LF output relative to that reading taken in (4) above. The difference should be less than 1 dB.

(6) Set the function generator to give 0.7 V output and repeat (4) and (5) above.

(7) Set the function generator to give 1.4 V output and repeat (4) and (5) above.

Mod input 2

(8) Connect the test equipment as in Fig. 5-1-7 except with the function generator output connected to EXT MOD 2 INPUT on the UUT.

(9) Set the UUT to EXT MOD 2 INPUT with ALC ON as follows:

[Select source] [Ext2 ALC Coupling] **[SIG GEN]**

(10) Reset the function generator as in (2) above and repeat (4) to (7) above.

TABLE 5-1-9 EXTERNAL MODULATION FREQUENCIES

External modulation frequencies			
10 Hz	50 Hz	20 kHz	200 kHz
20 Hz	1 kHz ref	100 kHz	500 kHz

Modulation ALC distortion

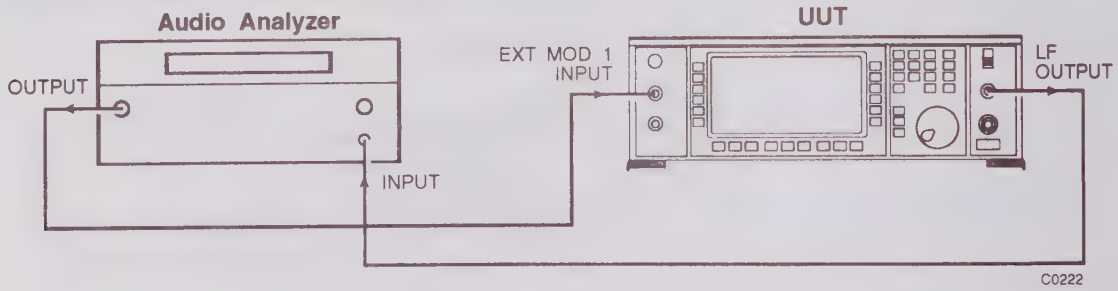

Fig. 5-1-8 Modulation ALC distortion test set-up

(1) Connect the test equipment as shown in Fig. 5-1-8.

(2) Set the UUT as in 'Mod input 1' (3) above.

(3) Set the audio analyzer to give 1 V RMS output and monitor distortion.

(4) Set the audio analyzer to 50 Hz, 1 kHz and 20 kHz measuring the distortion at each frequency which must be less than 0.1%.

(5) Connect the test equipment as in Fig. 5-1-8 except with the output from the audio analyzer connected to EXT MOD 2 INPUT on the UUT and set the UUT as in 'Mod input 2' (9) above.

(6) Repeat (4) above.

INTERNAL AM DEPTH AND DISTORTION

SPECIFICATION	
Range:	0 to 99% in 0.1% steps.
Accuracy:	For carrier frequencies up to 1 GHz, ±4% of setting ±1% depth. Usable to 1.35 GHz (2030), 2.7 GHz (2031), 5.4 GHz (2032).
Envelope distortion:	Less than 3% THD for AM depths up to 80% at 1 kHz modulation frequency. Less than 1% THD for AM depths up to 30% at 1 kHz modulation frequency.
Phase mod on AM:	Typically less than 0.1 rad at 30% depth on a 500 MHz carrier.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	1.5 MHz to 1 GHz. Accuracy: Better than 1.1%.	Marconi 2305 + distortion option

TEST PROCEDURES

Fig. 5-1-9 Internal AM depth and distortion test set-up

(1) Connect the test equipment as shown in Fig. 5-1-9.

(2) Set the UUT to *[RF level]* 0 dBm, *[Carrier freq.]* 1.5 MHz, *[AM]* 30%.

(3) Measure the AM depth and the envelope distortion on the modulation meter using the 50 Hz to 15 kHz filter setting at the frequencies shown in Table 5-1-10. Check that the measured AM depth and distortion are within specification.

(4) Set the UUT to an AM depth of 80% and repeat (3) above.

(5) Set the UUT to *[RF level]* 7 dBm and repeat (3) and (4) above.

TABLE 5-1-10 AM DEPTH AND DISTORTION FREQUENCIES

Carrier frequencies (MHz)	
1.5	400
31.0	500
43.0	850
200.0	1000

AM scale shape

(1) Connect the test equipment as shown in Fig. 5-1-9.

(2) Set the UUT to *[RF level]* 0 dBm, *[Carrier freq.]* 100 MHz, *[AM]* 1%.

(3) Measure the AM on the modulation meter at the depths shown in Table 5-1-11. Check that the measured depths are within specification.

TABLE 5-1-11 AM DEPTHS

AM depth (%)									
1	10	31	34	37	39.1	39.4	39.7	40	70
2	20	32	35	38	39.2	39.5	39.8	50	80
5	30	33	36	39	39.3	39.6	39.9	60	85

Phase modulation on AM

(1) With the test equipment set up as in Fig. 5-1-9, set the UUT to *[Carrier freq.]* 500 MHz, *[RF level]* 0 dBm, *[AM]* 30%.

(2) Measure the incidental phase modulation which should be typically less than 0.1 radian in a 50 Hz to 15 kHz bandwidth.

EXTERNAL AM

SPECIFICATION	
Accuracy:	With ALC OFF the modulation is calibrated for an input level of 1.0 V PD RMS sine wave.
Bandwidth:	±1 dB, DC to 50 kHz relative to 1 kHz Typically ±1 dB DC to 50 kHz, relative to 1 kHz.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	Modulation frequencies from 30 Hz to 50 kHz.	Marconi 2305
Function generator	DC to 50 kHz.	HP3325B
Power meter	Capable of measuring levels at 400 MHz.	Marconi 6960A and 6912 sensor

TEST PROCEDURES

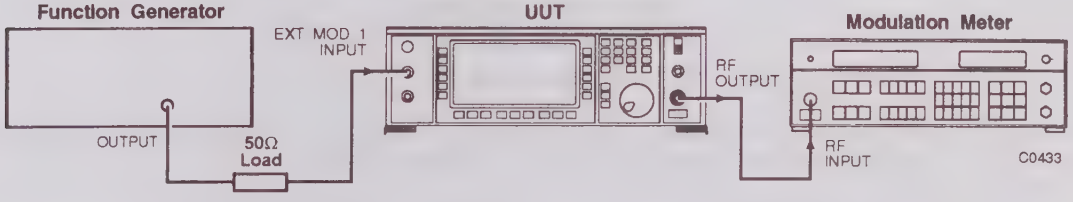

Fig. 5-1-10 External AM test set-up

(1) Connect the test equipment as shown in Fig. 5-1-10.

(2) Set the UUT to *[RF level]* 7 dBm, *[Carrier freq.]* 400 MHz, *[AM]* 80%. Then select EXT MOD 1 INPUT, DC coupled as follows:

[Select Source] [Select External] [Ext1 DC Coupling]
[SIG GEN]

(3) Set the function generator to give 1 V RMS at 1 kHz sine wave.

(4) With the modulation meter set to measure AM, set a reference using the relative function.

(5) Set the function generator to the frequencies shown in Table 5-1-12 and measure the change in external AM response which should be less than 1 dB with respect to 1 kHz.

TABLE 5-1-12 EXTERNAL AM TEST FREQUENCIES

Modulation frequency		
100 Hz	1 kHz	30 kHz
300 Hz	10 kHz	50 kHz

INTERNAL FM DEVIATION

SPECIFICATION	
Range:	1 MHz max for frequencies up to 21.09375 MHz. Up to 1% of carrier frequency for carrier frequencies above 21.09375 MHz.
Resolution:	3 digits.
Accuracy:	±5% of indication ±10 Hz at 1 kHz rate internal modulation source.
Distortion:	Less than 3% at maximum deviation for modulation frequencies up to 20 kHz.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	Minimum frequency 20 MHz	Marconi 2305 + distortion option

TEST PROCEDURES

(1) Connect the test equipment as shown in Fig. 5-1-9.

(2) Set the UUT to *[Carrier freq.]* 21 MHz, *[RF level]* 0 dBm, *[FM devn.]* 210 kHz. Measure the FM deviation on the modulation meter.

(3) Set up a carrier frequency step on the UUT of 1 MHz as follows:

[Δ] *[Set steps] [Carrier step]* 1 MHz **[SIG GEN]**

(4) Set up an FM deviation of 500 kHz and increment the carrier frequency up to 42 MHz using the ↑ key, measuring the deviation and distortion on the modulation meter at each step. (Note that the deviation will automatically be limited to 1% of the carrier frequency for each step.) Check that the measured deviations are within specification.

FM attenuator

(1) With the test equipment connected as in Fig. 5-1-9, set the UUT to *[Carrier freq.]* 31.64 MHz, *[RF level]* 0dBm, *[FM devn.]* 1,260 Hz.

1.26 kz ON NE PEUT PAS ENTRER 126

(2) Measure the FM on the modulation meter at the deviations indicated in Table 5-1-13. Check that the measured deviations are within specification.

TABLE 5-1-13 FM ATTENUATOR DEVIATIONS

Deviation (kHz)		
1.26	79	224
20	159	316

FM scale shape

(1) With the test equipment connected as in Fig. 5-1-9, set the UUT to *[Carrier freq.]* 31.64 MHz, *[RF level]* 0 dBm, *[FM Devn.]* 224 kHz.

(2) Referring to Table 5-1-14, measure the FM on the modulation meter at the deviations indicated.

TABLE 5-1-14 FM SCALE SHAPE DEVIATIONS

Deviation (kHz)		
224	256	289
228	261	293
233	265	298
238	270	302
242	275	307
247	279	312
252	284	316

EXTERNAL FM

SPECIFICATION	
Accuracy:	With ALC OFF the modulation is calibrated for an input level of 1.0 V PD RMS sine wave.
±1 dB bandwidth:	DC to 300 kHz. Typically 500 kHz.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	Modulation frequencies from 30 Hz to 50 kHz.	Marconi 2305
Function generator	DC to 300 kHz sine wave.	HP3325B
Frequency counter	Up to 40 MHz.	Marconi 2440

TEST PROCEDURES

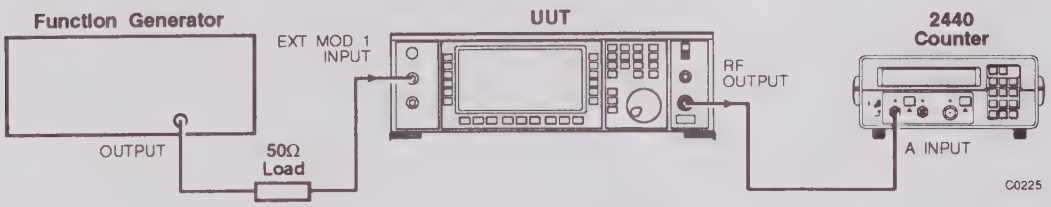

Fig. 5-1-11 External FM test set-up

(1) Connect the test equipment as shown in Fig. 5-1-10.

(2) Set the UUT to *[Carrier freq.]* 35,468,750.1 Hz, *[RF level]* 0 dBm, *[FM Devn.]* 40 kHz.

[UTIL] *[Mod'n mode] [Comp]*
[SIG GEN] *[Select Source] [Select External]*
[Ext1 AC Coupling]
[SIG GEN] *[FM2] [Select Source] [Ext2 AC Coupling]*
[SIG GEN] 40 kHz *[FM1]* 40 kHz

The UUT will now produce FM when the external modulating source is applied to either modulation input.

(3) Set the function generator to give 1 V RMS at 1 kHz sine wave.

(4) With the modulation meter set to measure FM, set a reference using the relative function.

(5) Set the function generator to the frequencies shown in Table 5-1-15 and measure the change in external FM response which should be less than 1 dB with respect to 1 kHz.

(6) To measure the FM deviation at DC, it will be necessary to connect the test equipment as shown in Fig. 5-1-11 and DC couple the EXT MOD 1 INPUT as follows:

[Select source] [Ext1 DC Coupling] **[SIG GEN]**

(7) Using the DC offset facility on the function generator, set up a voltage of +1.4142 V (i.e. $\sqrt{2}$).

(8) Measure and record the frequency indicated on the counter (F1).

(9) Set the function generator to give a DC voltage of -1.4142 V.

(10) Measure and record the frequency indicated on the counter (F2).

(11) Calculate the FM deviation using the following formula:

$$\frac{F1-F2}{2} = \text{Measured dev} = FM1$$

(12) It will now be necessary to reconnect the test equipment as shown in Fig. 5-1-10, reset the function generator to 1 kHz and measure the FM deviation on the modulation meter (FM2).

(13) Using the following formula, calculate the change in response which should be less than 1 dB:

$$20 \log_{10} \frac{FM2}{FM1}$$

(14) Transfer the function generator output to EXT MOD 2 INPUT on the UUT, select *[FM2]* and repeat (3) to (13) above.

TABLE 5-1-15 EXTERNAL FM RESPONSE FREQUENCIES

Modulating frequency (Hz)				
0	100	1,000	50,000	200,000
30	300	10,000	100,000	300,000

CARRIER FREQUENCY OFFSET

SPECIFICATION
In DC FM mode; less than ±(1 Hz +0.1% of the set deviation)

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Frequency counter	Up to 40 MHz.	Marconi 2440

TEST PROCEDURES

(1) Connect the test equipment as shown in Fig. 5-1-4.

(2) Short circuit the EXT MOD 1 INPUT.

(3) Set the UUT to *[Carrier freq.]* 1.35 GHz, *[RF level]* 0 dBm, *[FM Devn.]* 13.5 MHz, then proceed as follows:

[Select Source] [Select External] [Ext1 AC Coupling] **[SIG GEN]**

(4) Measure and record the carrier frequency on the counter.

(5) Set the UUT to DC coupled EXT MOD 1 INPUT as follows:

[Select Source] [Ext1 DC Coupling] [DCFM Nulling] **[SIG GEN]**

(6) Measure the change in carrier frequency (offset) which must be less than 13,501 Hz.

(7) Change the settings of the UUT as follows:

[Select Source] [Ext2 AC Coupling] **[SIG GEN]**

(8) Short circuit the EXT MOD 2 INPUT.

(9) After a 10 second settling period, measure and record the carrier frequency on the counter.

(10) Set the UUT to DC coupled EXT MOD 2 INPUT as follows:

[Select Source] [Ext2 DC Coupling] [DCFM Nulling] **[SIG GEN]**

(11) Measure the change in carrier frequency (offset) which must be less than 13,501 Hz.

INTERNAL PHASE MODULATION

SPECIFICATION	
Range:	Up to 10 radians in 0.01 radian steps
Accuracy:	Better than ±5% at 1 kHz
Distortion:	Less than 3% at 1 kHz modulation rate
Bandwidth:	±3 dB, 100 Hz to 10 kHz

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	Minimum frequency 20 MHz	Marconi 2305 + distortion option

TEST PROCEDURES

(1) Connect the test equipment as shown in Fig. 5-1-9.

(2) Set the UUT to *[Carrier freq.]* 21,093,750.1 Hz, *[RF level]* 0 dBm, *[ΦM]* 10 rad.

(3) Measure the phase modulation on the modulation meter which should read 10 rad ±0.5 rad.

Internal phase modulation flatness

(1) Connect the test equipment as shown in Fig. 5-1-9.

(2) Set the UUT to *[Carrier Freq.]* 21,093,750.1 Hz, *[RF Level]* 0 dBm, *[ΦM]* 10 rad, *[Select Source: F4]* 1 kHz.

(3) Set the modulation meter to measure FM with the 50 Hz - 15 kHz LF filter selected.

(4) Measure the deviation on the modulation meter and calculate the phase modulation using the formula:

$$\Phi M = \frac{\text{FM dev (Hz)}}{\text{mod freq* (Hz)}}$$

(5) Select the modulation source frequencies as shown in Table 5-1-16 using *[Select Source: F4]* on the UUT, then enter the frequency.

(6) Measure the deviation on the modulation meter for each modulation frequency and calculate the phase modulation for each step using the formula in (4) above.

*No allowances need be made for the modulation frequency accuracy since it is derived from the crystal reference oscillator in the UUT.

(7) Using the figure recorded in (4) as a reference, calculate the change in response at each modulation frequency using the formula:

$$20 \log_{10} \frac{\text{Figure recorded in (6)}}{\text{Figure recorded in (4)}}$$

The change in response should be less than 1 dB with respect to 1 kHz.

(8) Reset the modulation frequency on the UUT to 1 kHz.

(9) Using the modulation meter set to ΦM, select DIST and measure the distortion which must be less than 3%.

TABLE 5-1-16 MODULATION SOURCE FREQUENCIES

Modulating frequency (Hz)		
100	1,000	10,000
300	3,000	

SPECTRAL PURITY

SPECIFICATION	
Harmonically related signals for RF levels up to +7 dBm:	Less than -30 dBc for carrier frequencies up to 1 GHz. Less than -27 dBc for carrier frequencies up to 2.7 GHz (2031and 2032). Less than -27 dBc for carrier frequencies up to 5.4 GHz (2032 only).
Sub-harmonics:	Less than -90 dBc for carrier frequencies up to 1.35 GHz. Less than -40 dBc for carrier frequencies up to 2.3 GHz (2031 and 2032). Less than -30 dBc for carrier frequencies up to 2.7 GHz (2031 and 2032). Less than -30 dBc for carrier frequencies up to 5.4 GHz (2032 only).
Non-harmonics:	Less than -70 dBc for carrier frequencies up to 2.7 GHz at offsets of 3 kHz or greater. Less than -64 dBc for carrier frequencies up to 5.4 GHz (2032 only).
Residual FM:	Less than 7 Hz RMS in a 0.3 to 3.4 kHz unweighted bandwidth at a 470 MHz carrier.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	Capable of measuring Residual FM less than 7 Hz	Marconi 2305
Spectrum analyzer	10 kHz to 16.2 GHz frequency coverage	Marconi 2386

TEST PROCEDURES

Residual FM

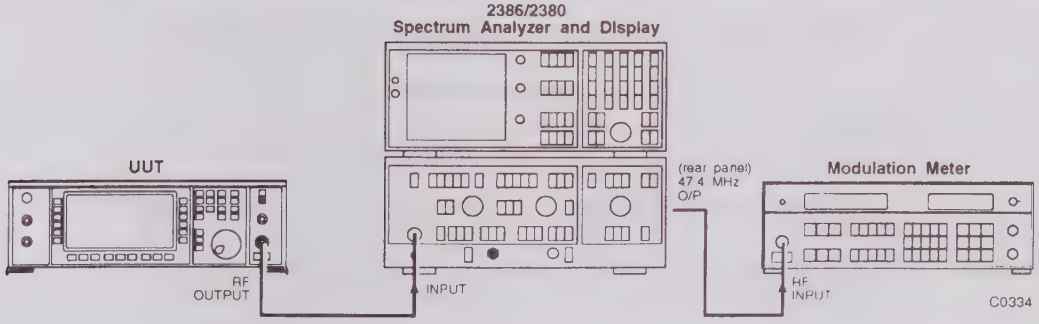

Fig. 5-1-12 Residual FM test set-up

(1) Connect the test equipment as shown in Fig. 5-1-12.

(2) Set the UUT to *[Carrier freq.]* 470 MHz, *[RF level]* 0 dBm, modulation OFF.

(3) Set the spectrum analyzer to 470 MHz zero span.

(4) Measure the residual FM on the modulation meter in a 300 Hz to 3.4 kHz bandwidth, which must be less than 7 Hz. RMS

Carrier harmonics

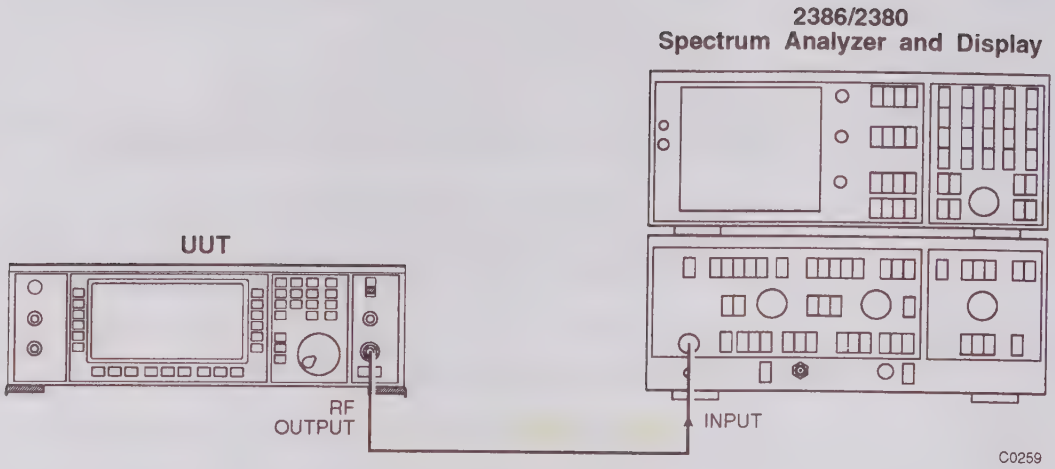

Fig. 5-1-13 Carrier harmonics test set-up

(1) Connect the test equipment as shown in Fig. 5-1-13.

(2) Set the UUT to *[Carrier freq.]* 10 kHz, *[RF level]* 7 dBm.

(3) On the spectrum analyzer measure the 2nd and 3rd harmonics of the carrier frequency which must be less than -30 dBc for carrier frequencies up to 1 GHz and less than -27 dBc for carrier frequencies above 1 GHz.

(4) Set the UUT to the frequencies indicated in Table 5-1-17 and repeat (3) above.

TABLE 5-1-17 CARRIER HARMONIC FREQUENCIES

Carrier frequencies (Hz)

(2030/1/2)			
10,000.0	42,187,500.1		
100,000.0	84,375,000.3	(2031/2)	(2032 only)
10,000,000.0	168,750,000.5	1,350,000,001.0	2,700,000,001.0
20,000,000.0	337,500,001.1	1,920,000,000.0	4,050,000,000.0
21,093,750.1	675,000,002.1	2,699,999,999.0	5,400,000,000.0

Carrier sub-harmonics (2031 and 2032 only)

(1) Connect the test equipment as shown in Fig. 5-1-13.

(2) Set the UUT to *[RF level]* +13 dBm, *[Carrier freq.]* 1,350,100,000.0 Hz.

(3) Referring to Table 5-1-18, measure the level of the sub-harmonics on the spectrum analyzer at the frequencies indicated. Check that the levels are within specification.

TABLE 5-1-18 CARRIER SUB-HARMONIC FREQUENCIES

UUT carrier frequency (Hz)	Spectrum analyzer frequency (Hz) $\frac{fc}{2}$	$\frac{3fc}{2}$
(2031/2)		
1,350,100,000.0	675,050,000.0	2,025,150,000.0
1,500,000,000.0	750,000,000.0	2,250,000,000.0
2,000,000,000.0	1,000,000,000.0	3,000,000,000.0
2,299,999,990.0	1,149,999,995.0	3,449,999,985.0
2,300,000,010.0	1,150,000,005.0	3,450,000,015.0
2,649,000,000.0	1,324,500,000.0	3,973,500,000.0
2,700,000,000.0	1,350,000,000.0	4,050,000,000.0

	$\frac{fc}{4}$ and $\frac{3fc}{4}$	$\frac{fc}{2}$ and $\frac{5fc}{4}$
(2032)		
2,701,000,000.0	675,250,000.0	1,350,500,000.0
	2,025,750,000.0	3,376,250,000.0
3,375,000,000.0	843,750,000.0	1,687,500,000.0
	2,531,250,000.0	4,218,750,000.0
4,050,000,000.0	1,012,500,000.0	2,025,000,000.0
	3,037,500,000.0	5,062,500,000.0
4,725,000,000.0	1,181,250,000.0	2,362,500,000.0
	3,543,750,000.0	5,906,250,000.0
5,400,000,000.0	1,350,000,000.0	2,700,000,000.0
	4,050,000,000.0	6,750,000,000.0

Non-harmonics

(1) Connect the test equipment as shown in Fig. 5-1-13.

(2) Set the UUT to *[RF level]* 0 dBm, *[Carrier freq.]* 10 kHz.

(3) Set the spectrum analyzer to a span of 100 Hz, 10 Hz filter, and referring to Table 5-1-19, measure the level of the non-harmonics at the frequencies indicated ensuring that the levels measured are less than -70 dBc.

TABLE 5-1-19 CARRIER NON-HARMONIC FREQUENCIES

UUT carrier frequency (Hz)	Spectrum analyzer frequency (Hz)
(2030/1/2)	
10,000.0	104,867,600.0
1,000,000.0	105,857,600.0
20,000,000.0	124,857,600.0
21,093,749.0	125,951,349.0
200,000,000.0	104,867,600.0
1,350,000,000.0	1,348,322,280.0 & 1,351,677,720.0
(2031/2)	
2,700,000,000.0	2,500,000,000.0
(2032)	
5,400,000,000.0	5,200,000,000.0

SSB phase noise

SPECIFICATION	
SSB phase noise :	Less than –116 dBc /Hz (typically -122 dBc/Hz) at an offset of 20 kHz from a carrier frequency

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Phase noise measuring device	Capable of measuring phase noise of –116 dBc	Marconi L262
Signal generator	SSB phase noise at least –116 dBc at 20 kHz offset from a 470 MHz carrier signal	Marconi 2040
Spectrum analyzer	Capable of measuring 100 Hz to 100 kHz	Marconi 2382

TEST PROCEDURES

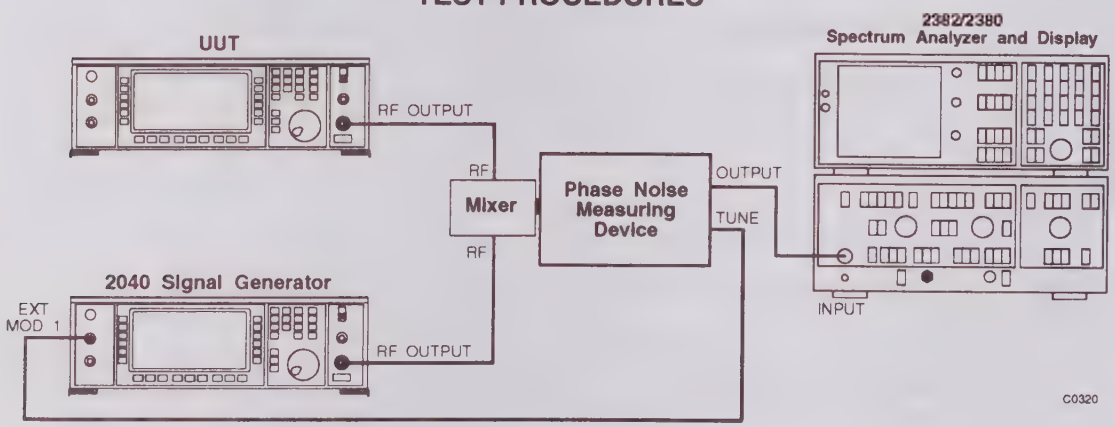

Fig. 5-1-14 SSB phase noise test set-up

(1) Connect the test equipment as shown in Fig. 5-1-14.

(2) Set the UUT to *[Carrier freq.]* 470 MHz, *[RF level]* 7 dBm, modulation to OFF.

(3) Using the phase noise measuring device, measure SSB phase noise at a 20 kHz offset which should be less than –116 dBc.

LAST COMPLETE CHECK DATE

On completion of the adjustment routine or of a calibration check, the date can be recorded. To do this, unlock the instrument to level 2, select the Calibration Utilities Menu, then press the *[Checks Complete]* key. This will result in the *Last Complete Check* date being updated to the current date.

CALIBRATION DUE DATE

The date of the next calibration check can be entered from the calibration utilities menu by pressing the *[Set Next Cal Date]* key. On reaching the calibration date, the instrument will display an error message indicating that it should be returned for a calibration check. The recommended calibration interval is 2 years.

REAL TIME CLOCK BATTERY

The real time clock uses a lithium battery to provide uninterrupted power regardless of whether the instrument is switched on or off. Although the estimated life of this battery is 4 years, customers may wish to replace it every 2 years.

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Chapter 5-1
Appendix A

ACCEPTANCE TESTING
SECOND MODULATION OSCILLATOR OPTION

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MODULATION OSCILLATORS

The following tests are for a 2030, 2031 or 2032 with the 2nd modulation oscillator fitted.

SPECIFICATION	
Frequency range:	0.1 Hz to 500 kHz
Accuracy:	Equal to the frequency standard accuracy
Resolution:	0.1 Hz
Distortion:	Less than 0.1% THD at frequencies up to 20 kHz sine wave mode

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Frequency counter	10 Hz to 500 kHz	Marconi 2440
Audio analyzer	Capable of measuring down to 0.03% THD from 100 Hz to 20 kHz	HP 8903B Rhode & Schwarz UPA 3

TEST PROCEDURES

Modulation oscillator frequencies

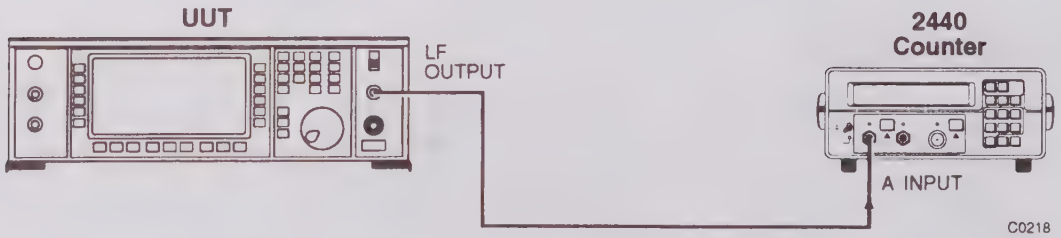

Fig. 5-1-A-1 Modulation oscillator frequencies test set-up

(1) Connect the test equipment as shown in Fig. 5-1-A-1.

(2) To enable both the modulation oscillators on the UUT, it will be necessary to carry out the following procedure:-

Press the following sequence of keys:

[UTIL] *[Mod'n Mode]* *[Comp]* **[SIG GEN]** *[Source Freq:]*

The frequencies of the first modulation oscillator may now be entered.

(3) Referring to Table 5-1-A-1, check that the oscillator frequencies can be selected correctly and are within specification.

(4) To monitor the second modulation oscillator, enter the following:

[FM2] [Select Source] [Select Internal] [Internal F1]
[LF] *[Mod2 Source]* **[SIG GEN]** *[Source Freq:]*

The frequencies of the second modulation may now be entered.

(5) Repeat (3) above.

TABLE 5-1-A-1 MODULATION OSCILLATOR FREQUENCIES

Modulation oscillator frequencies (Hz)	
10.00	279,620.20
139,810.10	500,000.00

Modulation oscillator distortion

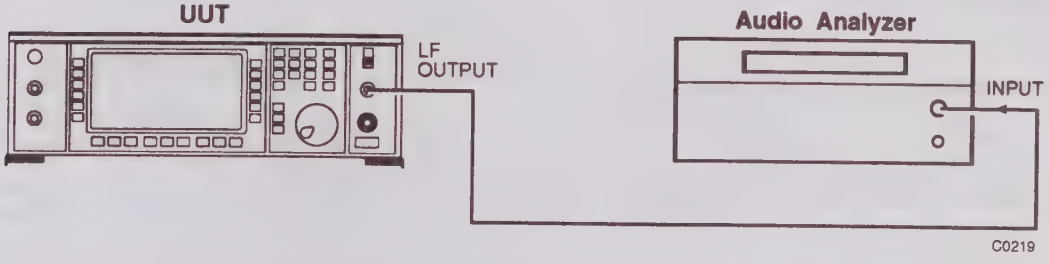

Fig. 5-1-A-2 Modulation oscillator distortion test set-up

(1) Connect the test equipment as shown in Fig. 5-1-A-2.

(2) Set the UUT such that the first modulation oscillator may be tested (refer to 'Modulation oscillator frequencies' step (2) above).

(3) Check that the distortion measured on the audio analyzer at the frequencies indicated in Table 5-1-A-2 is less than 0.1%.

(4) Set the UUT such that the second modulation oscillator may be tested (refer to 'Modulation oscillator frequencies' step (4) above).

(5) Repeat (3) above.

TABLE 5-1-A-2 DISTORTION FREQUENCIES

Modulation oscillator frequencies	
100 Hz	10 kHz
1 kHz	20 kHz

LF OUTPUT

SPECIFICATION	
Level accuracy:	±5% for levels above 50 mV, ±10% for levels from 500 µV to 50 mV (with a load impedance >10 kΩ)
Frequency response:	Typically better than 1 dB from 0.1 Hz to 300 kHz

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Digital multimeter	DC to 300 kHz, 1 mV to 5 V	Datron 1061A
Audio analyzer	Capable of measuring 0.5 mV ±3% and levels at 10 Hz	HP8903B Rhode & Schwarz UPA3

TEST PROCEDURES

Level accuracy

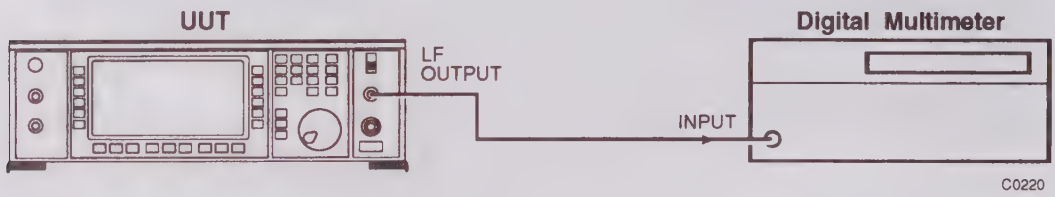

Fig. 5-1-A-3 Level accuracy test set-up

(1) Connect the test equipment as shown in Fig. 5-1-A-3.

(2) Set the UUT to give an LF output of 5 V at 1 kHz by entering the following:

[LF] *[LF Gen] [LF Freq]* 1 kHz, *[LF Level]* 5 V

(3) The level measured on the digital multimeter should read 5 V ±0.25 V.

(4) Check the LF output of the UUT at the levels indicated in Table 5-1-A-3. Check that the measured levels are within specification.

TABLE 5-1-A-3 LF OUTPUT LEVELS

LF Output Levels (V)		
5.0000	0.1000	0.0050
2.0000	0.0500	0.0020
1.0000	0.0200	0.0010
0.5000	0.0100	*0.0005
0.2000		

*For the last measurement it will be necessary to use the audio analyzer. Connect the test equipment as shown in Fig. 5-1-A-4.

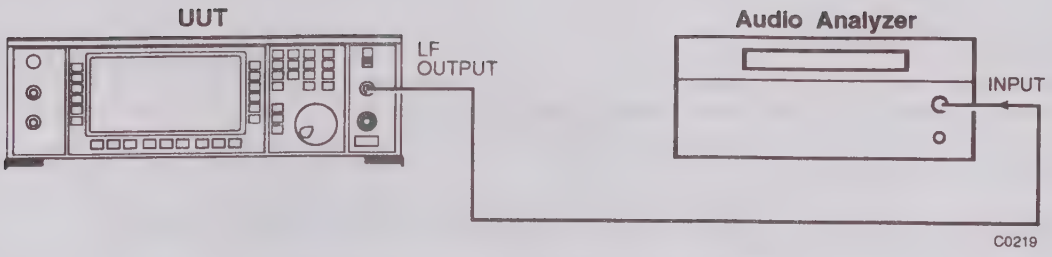

Fig. 5-1-A-4 LF output levels test set-up for 0.0005 V

Frequency response

(1) Connect the test equipment as shown in Fig. 5-1-A-2.

(2) Set the UUT to give an LF output of 1 V at 1 kHz on the first modulation oscillator (refer to 'Level accuracy' above).

(3) Reference this level on the audio analyzer using the dB relative function.

(4) Set the modulation oscillator to the frequencies given in Table 5-1-A-4 measuring the difference from the reference in (3) above which should be less than 1 dB.

(5) Set the UUT to give an LF output of 1 V at 1 kHz on the second modulation oscillator (refer to 'Level accuracy' above).

(6) Repeat (3) and (4) above.

TABLE 5-1-A-4 TEST FREQUENCIES

Test frequencies		
10 Hz	1 kHz ref	70 kHz
30 Hz	10 kHz	100 kHz
100 Hz	30 kHz	300 kHz

AM SCALE SHAPE

SPECIFICATION	
Range:	0 to 99% in 0.1% steps
Accuracy:	For carrier frequencies up to 1 GHz, ±4% of setting, ±1% depth. Usable to 2.7 GHz **(2031)**. Usable to 5.4 GHz **(2032)**.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	1.5 MHz to 1 GHz Accuracy: better than 1.1%	Marconi 2305 + distortion option

TEST PROCEDURES

Fig. 5-1-A-5 AM scale shape test set-up

(1) Connect the test equipment as shown in Fig. 5-1-A-5.

(2) Set the UUT to *[RF level]* 0 dBm, *[Carrier freq.]* 100 MHz, then enter the following:

[UTIL] *[Mod'n mode] [Comp]*
[SIG GEN] *[AM]* 1%

(3) Measure the AM on the modulation meter at the depths shown in Table 5-1-A-5. Check that the measured AM depth is within specification.

(4) Set the UUT by entering the following:

[AM1 ON/OFF] [AM2] [Select Source] [Select internal]
[Internal F4] **[SIG GEN]** 1%

(5) Repeat (3) above.

TABLE 5-1-A-5 AM DEPTHS

	AM depth (%)								
1	10	31	34	37	39.1	39.4	39.7	40	70
2	20	32	35	38	39.2	39.5	39.8	50	80
5	30	33	36	39	39.3	39.6	39.9	60	85

FM SCALE SHAPE

SPECIFICATION	
Range:	1 MHz max for frequencies up to 21.09375 MHz. Up to 1% of carrier frequency for carrier frequencies above 21.09375 MHz
Resolution:	3 digits
Accuracy:	±5% of indication ±10 Hz at 1 kHz rate internal modulation source

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	Minimum frequency 20 MHz	Marconi 2305 + distortion option

TEST PROCEDURES

(1) With the test equipment connected as in Fig. 5-1-A-5, set the UUT to *[Carrier freq.]* 31.64 MHz, *[RF level]* 0 dBm then enter the following:

[UTIL] *[Mod'n Mode] [Comp]*
[SIG GEN] *[FM2] [Select Source] [Select Internal]*
[Internal F4]
[SIG GEN] *[FM1]*

(2) The deviation for FM1 can now be entered. Referring to Table 5-1-A-6, measure the FM on the modulation meter at the deviations indicated. Check that the measured deviation is within specification.

(3) Set FM1 to 0 Hz deviation and select *[FM2]*.

(4) The deviation for FM2 can now be entered. Repeat (2) above.

TABLE 5-1-A-6 DEVIATION FREQUENCIES

Deviation (kHz)		
224	256	289
228	261	293
233	265	298
238	270	302
242	275	307
247	279	312
252	284	316

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Appendix B

ACCEPTANCE TESTING
PULSE MODULATION OPTION

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PULSE MODULATION

The following tests are for a 2030, 2031 or 2032 with the pulse modulation option fitted.

SPECIFICATION	
Maximum input level:	+5 V.
Minimum ON Level:	+3.5 V.
Maximum OFF level:	+1.0 V.
OFF/ON ratio :	Greater than 70 dB at the carrier frequency. Typically greater than 80 dB.
Additional output level error :	Less than 0.5 dB.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Power meter	±0.1 dB from 30 kHz to 2.7 GHz.	Marconi 6960A and 6912 sensor
Spectrum analyzer	Frequencies up to 1.4 GHz. Capable of measuring <-70 dBm.	Marconi 2386
Function generator	DC capability.	HP3325B

TEST PROCEDURES

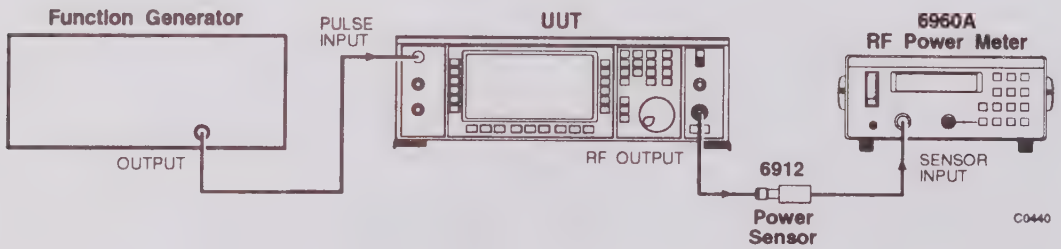

Fig. 5-1-B-1 Levels test set-up

Minimum 'ON' level

(1) Connect the test equipment as shown in Fig. 5-1-B-1.

(2) Set the UUT to *[RF level]* 0 dBm *[Carrier freq.]* 10 MHz and *[Pulse Mod.]*.

(3) Set the function generator to give +3.5 V DC. The 0 dBm level should now appear on the power meter.

Maximum 'OFF' level

(4) Set the function generator to give 1.0 V DC. The 0 dBm level should now disappear from the power meter.

Additional level error

(1) Set the UUT to *[Carrier Freq.]* 1 MHz, *[RF level]* 0 dBm.

(2) Measure and record the RF level indicated on the power meter (P1).

(3) Set the UUT to *[Pulse Mod.]*

(4) Set the function generator to give +5 V DC.

(5) Measure and record the RF level indicated on the power meter (P2).

(6) The difference between P1 and P2 must be less than 0.5 dBm.

ON/OFF ratio

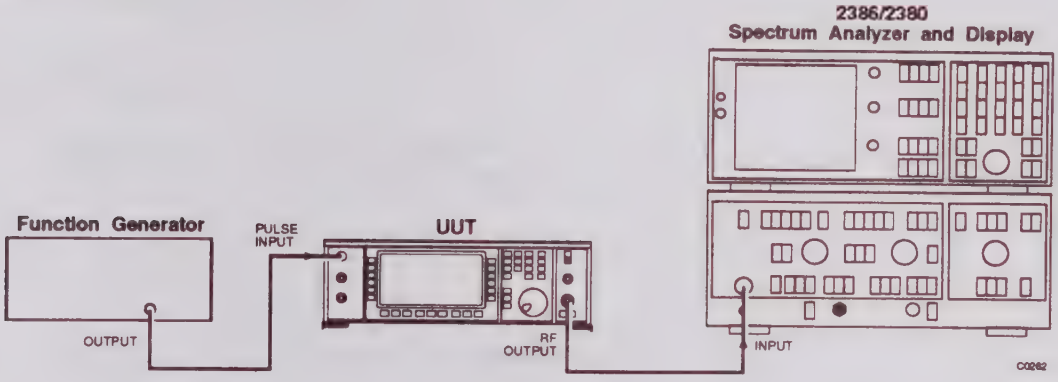

Fig. 5-1-B-2 ON/OFF ratio test set-up

(1) Connect the test equipment as shown in Fig. 5-1-B-2.

(2) Set the UUT to *[Carrier Freq.]* 11 MHz, (RF level) 0 dBm, and *[Pulse Mod].*

(3) Set the function generator to give +5 VDC.

(4) Set the spectrum analyzer to 11 MHz, span/div 10 kHz, and, using the 'Peak Find' facility, measure the amplitude of the carrier signal and record as (P1).

(5) Set the function generator to give 0 V DC.

(6) Measure the amplitude of the carrier signal and record as (P2). The difference between P1 and P2 must be greater than 70 dB.

(7) Repeat (3) to (6) above for the UUT and spectrum analyzer frequencies shown in Table 5-1-B-1.

TABLE 5-1-B-1 ON/OFF RATIO CARRIER FREQUENCIES

Carrier frequencies		
11 MHz	675 MHz	1.349,999 GHz
111 MHz	1 GHz	

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Chapter 5-1
Appendix C

ACCEPTANCE TESTING
HIGH OUTPUT POWER OPTION

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The following tests are for a 2030 fitted with the +19 dBm option (high output power).

RF OUTPUT LEVEL

SPECIFICATION	
Level range:	-138 dBm to +19 dBm.
Accuracy :	±1.2 dB from 10 kHz to 1.35 GHz.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
RF power meter	±0.1 dB from 30 kHz to 2.7 GHz.	Marconi 6960A and 6912 sensor

TEST PROCEDURES

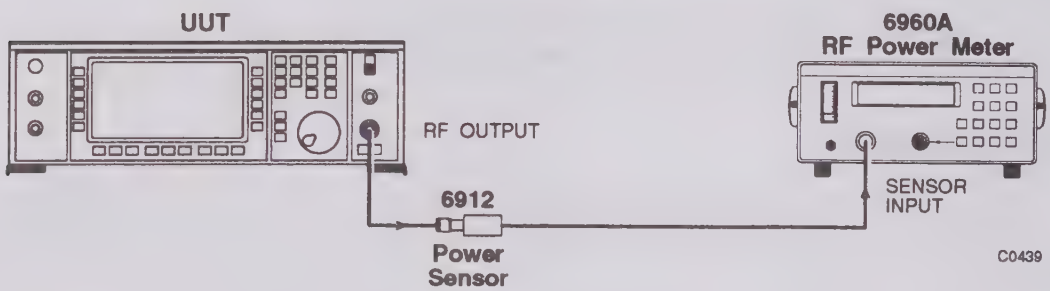

Fig. 5-1-C-1 RF output and ALC linearity test set-up

(1) Connect the test equipment as shown in Fig. 5-1-C-1.

(2) Set the UUT to *[RF level]* 6.1 dBm, *[Carrier freq.]* 30 kHz.

(3) Check that the output level is within ±1.2 dBm at the frequencies shown in Table 5-1-C-1.

(4) Set the UUT RF output to 13 dBm and repeat (3) above.

(5) Set the UUT RF output to 19 dBm and repeat (3) above.

TABLE 5-1-C-1 RF OUTPUT TEST FREQUENCIES

Frequency (MHz)	
0.03	675
0.1	825
75	975
225	1125
375	1275
525	1350

ALC LINEARITY

(1) Connect the test equipment as shown in Fig. 5-1-C-1.

(2) Set the UUT to *[Carrier freq.]* 2.5 MHz, *[RF level]* 6 dBm.

(3) Increment the RF output of the UUT in 1 dB steps up to 18 dBm and in 0.1 dBm steps up to 19 dBm, measuring the RF level at each step.

(4) Set the UUT carrier frequency to 500 MHz and repeat (3) above.

(5) Set the UUT carrier frequency to 1.35 GHz and repeat (3) above.

CARRIER HARMONICS

SPECIFICATION	
Harmonically related signals:	Less than -27 dBc for carrier frequencies up to 1.35 GHz.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Spectrum analyzer	10 kHz to 4.1 GHz frequency coverage.	Marconi 2386

TEST PROCEDURES

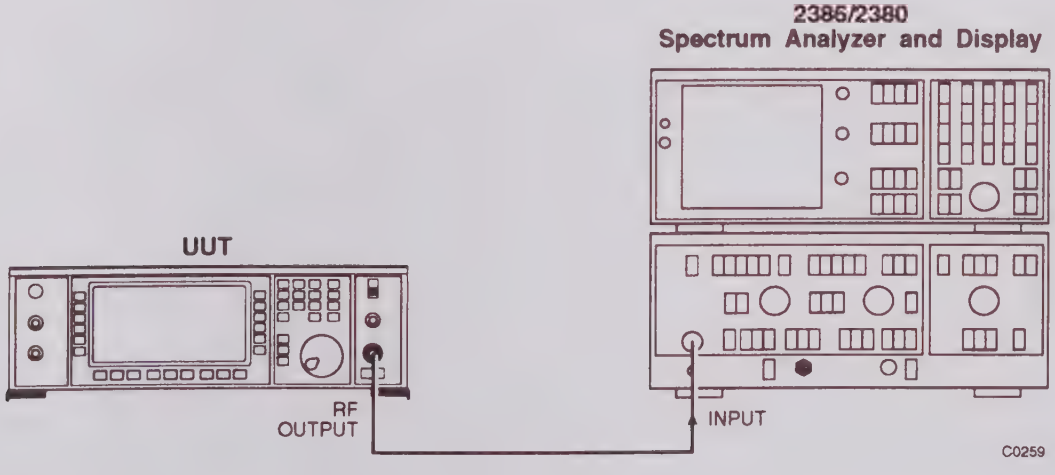

Fig. 5-1-C-2 Carrier harmonics test set-up

(1) Connect the test equipment as shown in Fig. 5-1-C-2.

(2) Set the UUT to *[Carrier freq.]* 10 kHz, *[RF level]* 0 dBm.

(3) On the spectrum analyzer measure the 2nd and 3rd harmonics of the carrier frequency which must be less than -27 dBc.

(4) Set the UUT to the frequencies indicated in Table 5-1-C-2 and repeat (3) above.

TABLE 5-1-C-2 CARRIER HARMONIC FREQUENCIES

Carrier frequencies (Hz)	
10,000.0	42,187,500.1
100,000.0	84,375,000.3
10,000,000.0	168,750,000.5
20,000,000.0	337,500,001.1
21,093,750.1	675,000,002.1

Annex A
OPTION 005 GMSK Bt 0.3

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GENERAL DESCRIPTION

This option adds GMSK (Gaussian Minimum Shift Keying) modulation at a bit rate of 270.833 kHz to the 2030 series. This modulation is used by the GSM (Global System for Mobile communications) and UK PCN (Personal Communication Network) system

Front panel connectors provide external modulation inputs for clock, data and envelope control. The wide band FM input is available for doppler simulation.

Facilities are provided for modulation by an internal data source and for editing the data. The front panel connectors provide outputs for clock and data in this mode.

Instruments may be locked together via the SYNC connectors to allow multi-carrier signals to be generated.

A 2030 or 2031 Signal Generator fitted with the GMSK option, conforms to the 2030 series specification when in GSM mode (performance is not affected in other modes) except as follows:

PERFORMANCE DATA

CARRIER FREQUENCY

Range	2030: 10 MHz to 1.34675 GHz. 2031: 10 MHz to 2.69675 GHz.

RF OUTPUT

Range:	0 dBm to -144 dBm.
Accuracy:	Less than ±2 dB for carrier frequencies 10 MHz to 2 GHz.
Output VSWR:	As for 2030 series for levels below -6 dBm.

SPECTRAL PURITY

Non-harmonic output

GMSK signals are generated by mixing a local oscillator with a 3.25 MHz IF signal carrying the GMSK signal. Additional signals are present at the local oscillator frequency, image frequency and frequencies equivalent to the harmonics of the IF mixed with the local oscillator.

FREQUENCY STANDARD

In GSM mode an input or output at 1, 5, 10 or 13 MHz is available. On external standard input sensitivity is 0 dBm.

OUTPUT VSWR	Specification applies to output levels less than -6 dBm.
RF LEAKAGE	Specification applies for carrier frequencies up to 2 GHz.

GMSK MODULATION

Modulation type

GMSK Bt 0.3 to GSM recommendation 05.04.

Modulation accuracy

Phase accuracy as defined by GSM 05.05 - 4.6 is 1° RMS, 3° peak for carrier frequencies up to 1 GHz.

Data coding

Selectable as uncoded, or differentially coded to GSM recommendation 05.04 - 2.3 for internal or external modulation.

INTERNAL MODULATION

An internal data source provides a Traffic Channel format superframe hierarchy. Individual slots may be null data, fixed data, or contain (2^9-1) Pseudo Random Binary Sequence (PRBS) data as defined in CCITT rec. V.52. Successive slots contain 156, 156, 156, 157 bits when on internal clock or external 'integer' clock. An internal data source provides data output on the DATA and clock on the CLOCK connectors. Internal data can either be edited from the front panel and stored or entered using the GPIB.

The RF envelope may be ramped up and down to GSM 05.05 annex 2 and GSM 05.05 - 4.2.2.

The internal data generator can be used with an external clock as in 'External Modulation'.

Data storage

Data in the data generator can be stored and edited from the front panel or via the GPIB. Data store sizes are:

100 slots of which 2 are defined as null (SLOT 0) and PRBS (SLOT 99)
100 frames containing any of the stored slots in any order
100 multiframes containing any of the stored frames in any order
50 superframes containing any of the stored multiframes in any order.

Internal modulation outputs

Data output:	TTL compatible.
Clock output:	TTL compatible.

EXTERNAL MODULATION

Clock and data input at TTL compatible levels. Data must be valid on the falling edge of the clock input.

Data input level:	TTL compatible.
Clock input level:	TTL compatible.
Clock input frequency:	270.833 kHz ±25 parts/10^6 or a clock of the same bit rate but including one clock period of 1 1/4 bits per slot.
Envelope input impedance:	15 kΩ nominal.
Doppler FM input impedance:	50 Ω.

ENVELOPE CONTROL

Controlled by selectable constant internal level, or from the external ENVELOPE input. External envelope levels are 0 V for off, +1 V for specified RF level. The RF output voltage varies linearly with applied voltage.

Input rise time:	Less than 4 µs.
Off slot suppression:	Better than -70 dBc at 0 V.

MODULATION SENSE

Output frequency can be set to upper or lower sideband. Modulation sense can be inverted.

SYNCHRONIZATION

Instruments may be synchronized by use of the SYNC input/output. One instrument in Master mode sources a bit clock and the SYNC signal. The SYNC signal goes active low for one bit during the transition of the internal data from slot 7, bit 156 to slot 0, bit 0. Instruments in Slave mode use Clock and Sync signals to remain in synchronism.

Synchronization input/output :	Open collector TTL 2 mA pull-up, active low, bidirectional.

GMSK OPERATION

INTRODUCTION

This chapter explains how to use Option 005 GMSK Bt 0.3 when fitted to a 2030 or 2031 Signal Generator. Familiarity with the normal operation of the instrument is assumed.

FRONT PANEL

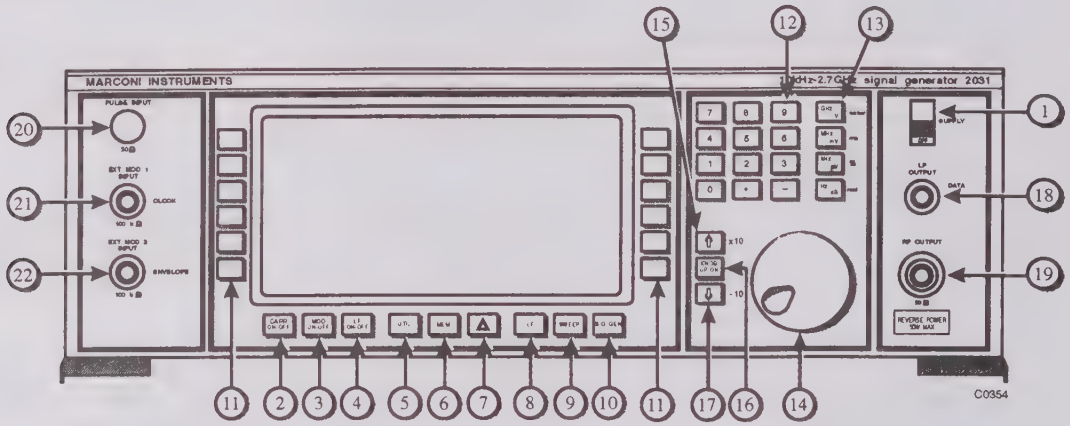


Fig. A-1 2031 series front panel with Option 5

(1)	SUPPLY	Switches the AC supply voltage on and off.
(2)	CARR ON-OFF	Enables or disables the carrier frequency.
(3)	MOD ON-OFF	Enables or disables the modulation.
(4)	LF ON-OFF	Switches the low frequency output on and off.
(5)	UTIL	Displays the utilities menu.
(6)	MEM	Displays the memory store/recall menu.
(7)	Δ	Displays the total shift menu.
(8)	LF	Displays the LF and monitor menus.
(9)	SWEEP	Displays the sweep status menu.
(10)	SIG GEN	Displays the main menu.
(11)	SOFT KEYS	Twelve function keys change notation as the menu changes.
(12)	NUMERICAL KEY PAD	For changing the value of a selected parameter. Minus sign and decimal point are included.
(13)	UNITS KEYS	Determine the units of set parameters and terminate the numerical entry.

(14)	CONTROL KNOB	When enabled, adjusts the value of the selected parameter.
(15)	⇑ × 10	When knob disabled, increments a selected parameter. When knob enabled, increases knob sensitivity by value of ten.
(16)	KNOB UP-DN	Switches between control knob and ⇑⇓ keys.
(17)	⇓ ÷ 10	When knob disabled, decrements a selected parameter. When knob enabled, decreases knob sensitivity by value of ten.
(18)	LF OUTPUT or DATA	BNC socket provides a low impedance output at the frequency selected at the *LF GENERATOR MENU* or monitors the modulating signal. In GSM mode the connector is used for data input or output.
(19)	RF OUTPUT	50 Ω N type socket with reverse power protection.
(20)	PULSE	50 Ω BNC socket (if fitted) accepts a pulsed signal.
(21)	EXT MOD 1 or INPUT CLOCK	100 kΩ BNC socket. An independent input which allows an external modulation signal to be applied. In GSM mode it is used for clock input/output.
(22)	EXT MOD 2 or INPUT ENVELOPE	100 kΩ BNC socket, similar to (21). In GSM mode the connector is used for external envelope control.

REAR PANEL

The following facilities are available on the rear panel, see Fig. A-2.

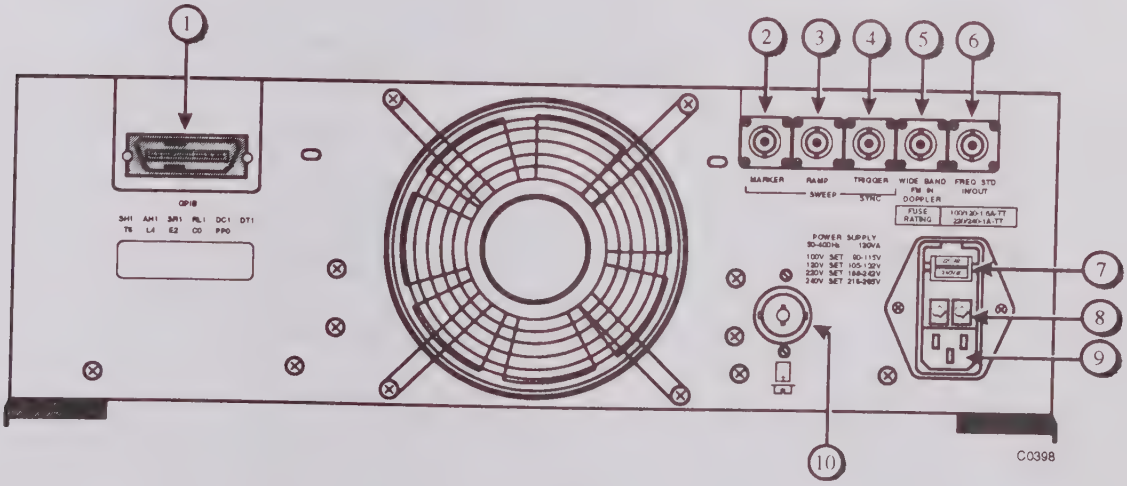


Fig. A-2 2031 rear panel with Option 5

(1)	GPIB	24 pin socket accepts standard IEEE connector to allow remote control of the instrument.
(2)	SWEEP MARKER	BNC socket supplies sweep marker.
(3)	SWEEP RAMP	BNC socket provides a ramp output at 0 to 10 V peak-to-peak.
(4)	SWEEP TRIGGER or SYNC	BNC socket provides access for a trigger input or SYNC input/output in GSM Mode.
(5)	WIDE BAND FM IN or DOPPLER	BNC socket accepts a wide bandwidth FM signal into 50 Ω with a typical bandwidth of 10 MHz. In GSM mode the connector may be used for doppler simulation.
(6)	FREQ STD IN/OUT	BNC socket for standard frequencies at 1, 5 or 10 MHz at TTL levels. In GSM mode an additional standard of 13 MHz can be accepted and generated.
(7)	VOLTAGE SELECTOR	Removable cover reveals barrel which can be rotated to select the required voltage range.
(8)	FUSES	AC fuses rated at 1.6 A TT (double time lag) for the 100 to 120 V range and 1 A TT (double time lag) for the 220 to 240 V range.
(9)	AC SUPPLY INPUT	3 pin plug integral with voltage selector and fuse holders. Mates with supply lead socket.
(10)	BATTERY HOLDER	Houses battery for real time clock.

GSM MODE

The GSM mode of operation is an additional modulation mode. To enter this mode press the [UTIL] key and select the *[Mod'n Mode]* from the Utilities Selection Menu (see Fig. A-3).

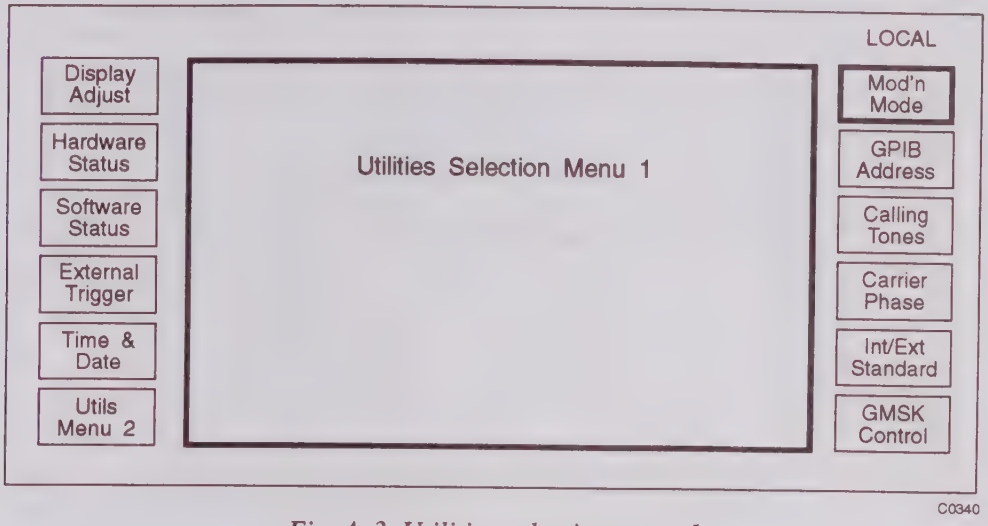


Fig. A-3 Utilities selection menu 1

Use the *[GMSK]* key shown in Fig. A-4 to select the GSM mode of operation.

Note...

If the GSM modulation mode is not selected, the GSM data and controls can be edited and modified but GSM signals cannot be generated.

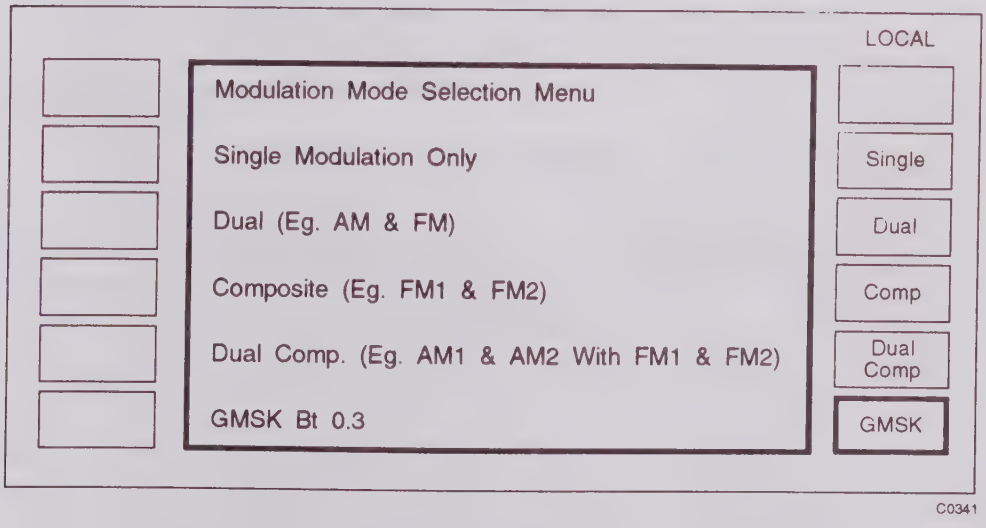


Fig. A-4 Modulation mode selection with GMSK

GMSK CONTROL

To set the GMSK control function, return to the Utilities Selection Menu 1 shown in Fig. A-3 and press the *[GMSK Control]* key to obtain the display shown in Fig. A-5.

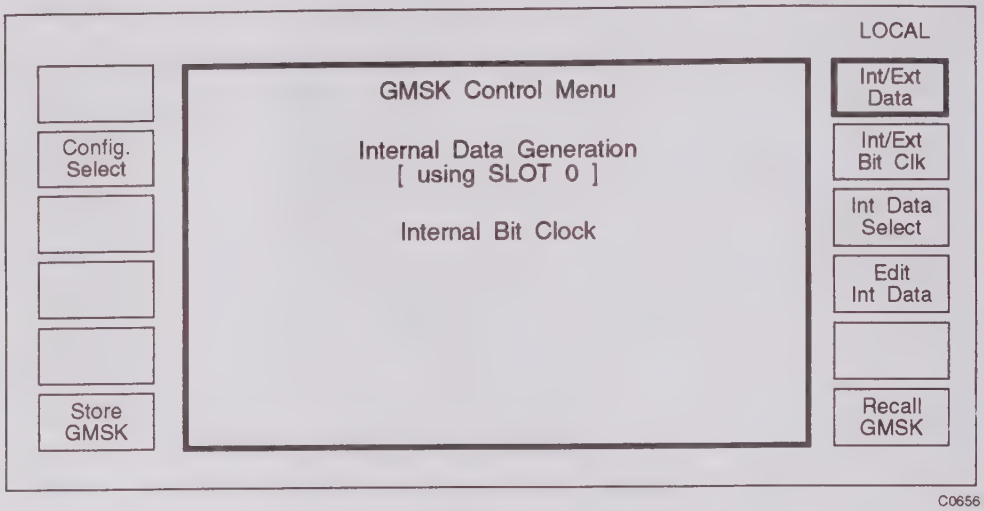


Fig. A-5 GMSK control menu with external data selected

Alternatively the [*GMSK Control*] key can be accessed by pressing the [SIG GEN] key to obtain the menu shown in Fig. A-6 (provided the GMSK modulation mode has been enabled).

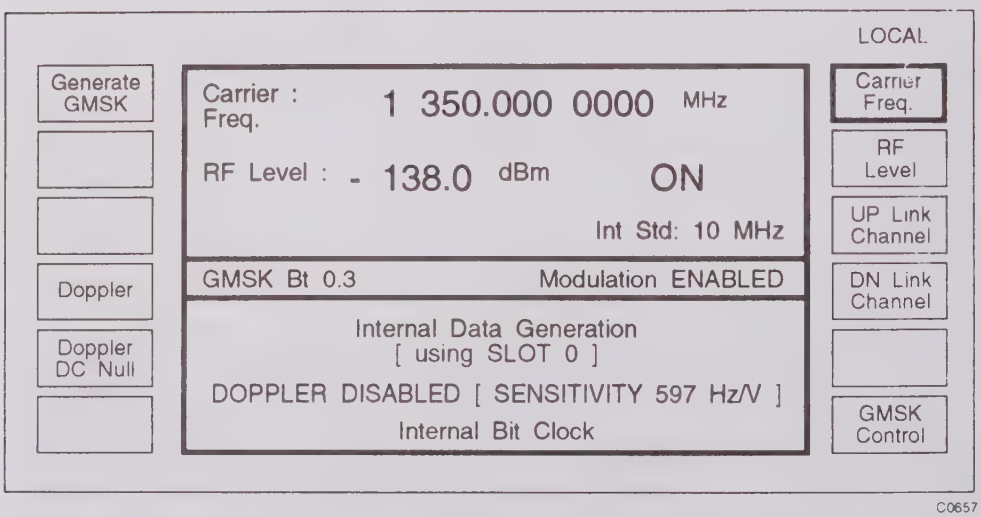


Fig. A-6 Sig. Gen. menu with internal data selected

Configuration select

Configuration select is used to set the way in which the GSM generator interacts with internal and external control signals. To set up the GSM configuration, press the *[Config. Select]* key shown in Fig. A-5 to obtain the menu shown in Fig. A-7.

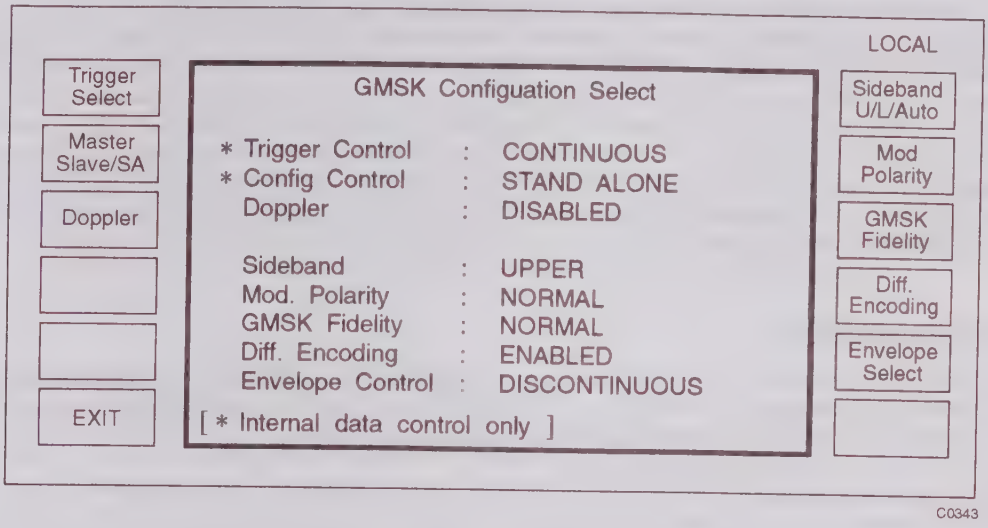


Fig. A-7 GMSK configuration selection menu

Trigger control

The *[Trigger Select]* key can be set to continuous or single trigger operation. In continuous mode the data from the internal data generator is repeated continuously while in the single mode the data is only generated once.

Configuration control

When using the internal data generator the instrument may be set to stand alone, master or slave mode using the *[Master/Slave/SA]* key. When *STAND ALONE* is selected the instrument responds in the normal way to GPIB or keyboard commands. When *MASTER* is selected the instrument generates a clock output from the CLOCK connector and a synchronizing signal from the SYNC connector on the rear panel. By connecting the clock and sync signals to a generator set to the slave mode the master will control the timing of the data generator in the slave instrument such that if the two RF signals are compared their slot/frame structures are in synchronism. This allows the generator to be used in applications requiring two or more sources of GMSK signal.

Doppler

With Doppler set to *ENABLED* the DOPPLER input on the rear panel of the instrument may be used to frequency modulate the carrier using an external source to simulate the effect of Doppler frequency shifts. The DOPPLER input can also be used to add FM signals to simulate the effect of receiving signals with a GMSK phase error .

The sensitivity, in Hz/V, of the DOPPLER input is displayed on the Sig. Gen. Menu (Fig. A-6). The sensitivity is carrier frequency dependent since it uses the same input as

Wideband FM and the instrument sets the sensitivity to be close to 500 Hz/V or the minimum sensitivity available (at 2 GHz the minimum sensitivity is typically 1200 Hz/V).

Sideband

The GMSK signals are generated by frequency converting a 3.25 MHz IF signal up to the required output frequency. Local oscillator frequencies at 3.25 MHz offset and an image frequency at 6.5 MHz offset of equal amplitude to the wanted signal are generated. The *[Sideband U/L/Auto]* key can be used to select the wanted GMSK signal and where the image frequency occurs. If *UPPER* sideband is selected the image and local oscillator frequencies are below the GMSK frequency. If *LOWER* sideband is selected the image and local oscillator frequencies are above the GMSK frequency. If *AUTO* is selected the generator automatically selects upper or lower sideband generation so as to generate the unwanted signals towards the centre of the GSM or PCN band.

Modulation polarity

The *[Mod. Polarity]* key can be used to select either *NORMAL* modulation sense or *INVERSE* modulation sense. *INVERSE* can be used to simulate IF signals where the modulation sense has been reversed in frequency converting the input RF signal.

GMSK fidelity

The *[GMSK Fidelity]* key can be used to select either *NORMAL* which provides accurate GMSK Bt 0.3 modulation or *CORRUPT* which results in the generation of a signal with a RMS phase trajectory error of typically 5° RMS (±10° peak). *CORRUPT* can be used to test the tolerance of a receiver to GMSK errors.

Differential encoding

The GSM specification requires that the data is differentially encoded. This is accomplished by setting the Differential Encoding to *ENABLED*. The differential encoder can be *DISABLED* when it is more convenient to work with uncoded data (e.g. when working with a basic demodulator).

Envelope select

The *Envelope Control* can be set to *CONTINUOUS* or *DISCONTINUOUS* using the *[Envelope Select]* key.

With *CONTINUOUS* envelope selected the RF signal is maintained at a constant level with no amplitude shaping being present.

When *DISCONTINUOUS* envelope is selected and an external data/clock source is being used, the RF Envelope is controlled using the ENVELOPE input on the front panel. The level is linearly controlled with 0 Volts producing no output and +1 V producing the nominal RF output. When using the internal data generator on *DISCONTINUOUS* envelope control, the RF output is suppressed at the start and end of each slot and remains suppressed on null slots.

Exit

Using the *[EXIT]* key on the GMSK Configuration Menu will return the operator to the GMSK Control Menu.

STORE/RECALL GMSK

The GMSK control settings can be stored or recalled using the *[Store GMSK]* and *[Recall GMSK]* keys on the GMSK Control Menu (Fig. A-5). The stores contain the settings of all the information on the GMSK Control Menu, including those set by the GMSK *[Configuration Select]*, but do not include other parameters displayed on the Sig Gen menu (e.g. carrier frequency, level). The facility provides a simple means of storing and recalling modulation settings without changing the carrier frequency and level. Valid store numbers are 0 to 19.

Note...

If a full store and recall facility is required, including carrier frequency and level, then the Full Store and Full Recall facilities accessed by the [MEM] key should be used. When a setting is Recalled the Full store includes the Modulation Mode setting (i.e. whether it is in GSM mode) but not those parameters stored by the *[Store GMSK]* key.

EXTERNAL DATA/CLOCK OPERATION

To generate GMSK Bt 0.3 modulation from an external source a data and clock source are required. The RF envelope can be set to continuous or external control via the ENVELOPE input using the Configuration Selection menu. External data mode is selected from the GMSK Control Menu using the *[Int/Ext Data]* key. In external data mode the clock input is used to phase lock the 13 MHz data generator clock and the RF output frequency is phase locked to this standard. If the clock is not applied *Error 06 : VCXO Out of Lock* or *Error 43 : No External Bit Clock* will appear at the top of the display.

Data must be valid on the falling (negative) edge of the clock input.

The clock frequency must either be 270.833 kHz, the GSM bit rate, or have a clock sequence with 155 successive periods corresponding to the GSM bit rate followed by 1 period corresponding to 1 1/4 bits of the GSM bit rate. The instrument will automatically lock on to either signal.

The presence of a 1 1/4 bit period will introduce a phase discontinuity on the RF signal at a time corresponding to approximately 3 bits in advance of the 1 1/4 bit period. The position of this phase discontinuity can be retarded in time using hardware links. Assuming the factory set condition is used and the 1 1/4 bit period is on Bit 156, the phase discontinuity is in the guard bits and has no effect on a receiver.

Note...

In GSM mode the DATA input is used as the LF OUTPUT. This output is a low impedance source and care should be taken in connecting it to sensitive external loads. The LF OUTPUT is internally protected.

Setting the output carrier

The carrier output frequency and level are set by pressing the [SIG GEN] key to obtain the display shown in Fig. A-8. Carrier frequency and RF level can be selected and entered in the normal way.

Note...

In GSM mode the RF level extended hysteresis function is not available.

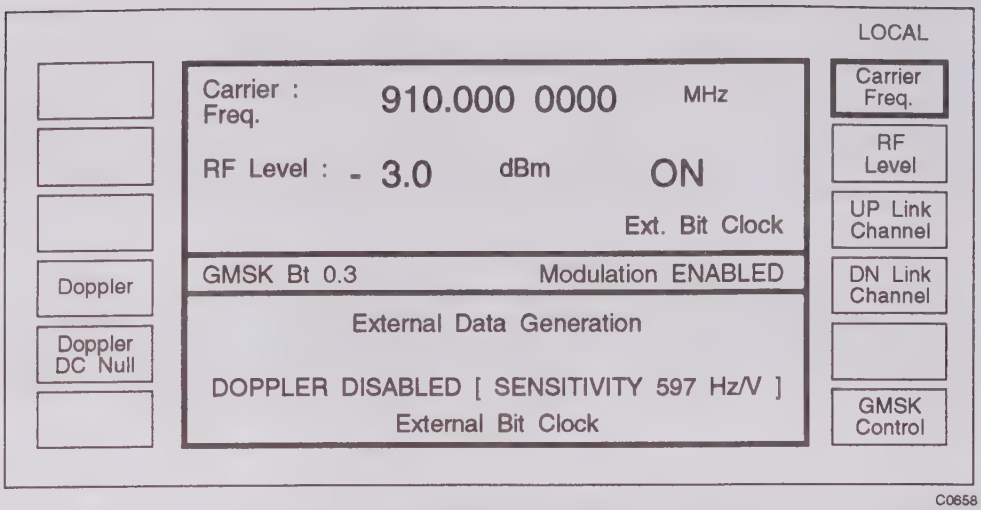


Fig. A-8 Sig. Gen. menu in GSM mode with external data/clock

In addition the carrier frequency can be edited directly by entering the channel number specified in the GSM and PCN standards. For GSM the usable channels are numbered 1 to 124 and for PCN are numbered 512 to 885. The channel frequencies are entered using *[UP Link Channel]* or *[DN Link Channel]* keys followed by the channel number and the [enter] key to set the mobile to base station and base station to mobile frequencies respectively.

INTERNAL DATA GENERATION MODE

The 2030 series GMSK option includes an internal data generator which obtains data from any of 100 slots. The slot information can be stored in a non-volatile store. The slots can be assembled into a frame structure and up to 100 of these frames may be stored. A 26 frame multiframe can in turn be assembled from any of the stored frames and up to 100 multiframes stored. The multiframes can be assembled into a 51 multiframe structure and up to 40 superframes can be stored. Any of slots/frames/multiframes/superframes may be used as the data source. The data can be generated once only or continuously repeated.

Data can be edited and stored from the front panel or from the GPIB.

The internal data generator can also be used with an external clock source as described under 'External Data/Clock Operation'.

Internal data selection

From the GMSK Control Menu, Fig. A-9, select *[Int Data Select]* to obtain the GMSK Internal Data Select menu shown in Fig. A-10. The *[SLOT], [FRAME], [MULTIFRAME], [SUPERFRAME]* keys may be used to select the data as slot, frame multiframe or superframe.

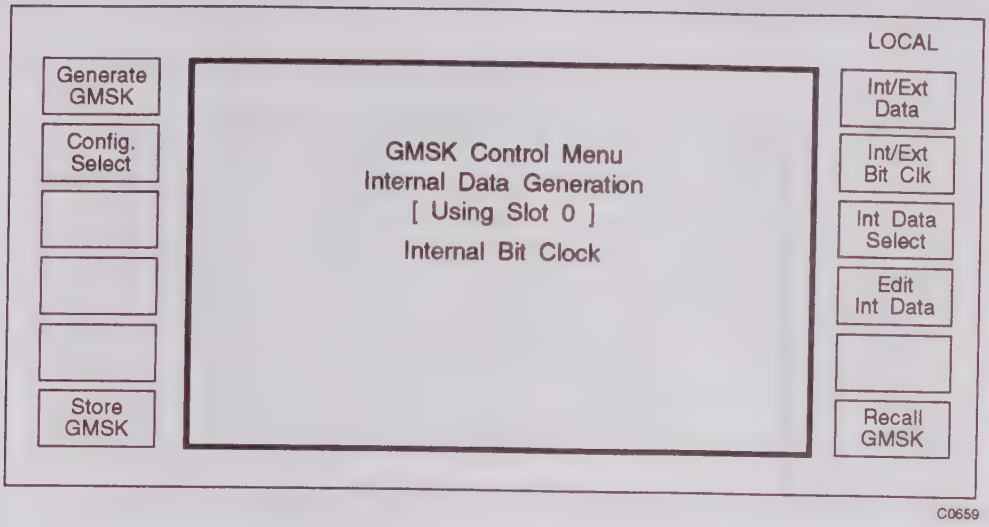


Fig. A-9 GMSK control menu

If slot data is selected the display shows the slot information as shown in Fig. A-10. The data is displayed as logical '1's and '0's. The first line of data shows the 3 tail bits, the second and third lines show 57 bits of data, the fourth line is a control bit, the fifth line is the midamble training sequence, the sixth line a control bit, the seventh and eighth lines the second block of 57 data bits and the ninth line consists of 3 tail bits.

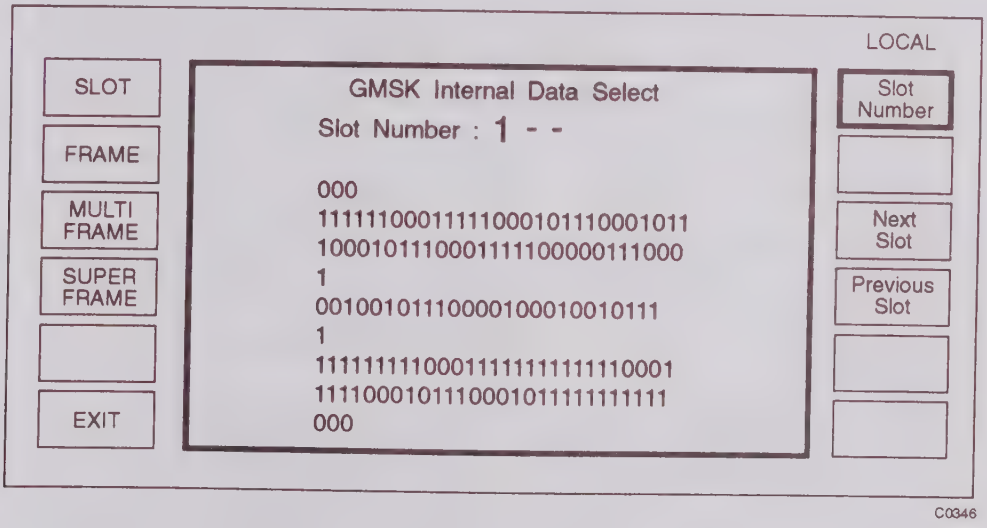


Fig. A-10 GMSK internal data selection menu with slot selected

Any slot number can be selected using *[Slot Number]* followed by a one or two digit number and terminated with the [enter] key. The *[Next Slot]* and *[Previous Slot]* keys provide a means of looking at slot information in the adjacent slot stores.

If frame data is required, selecting *[FRAME]* from the GMSK Internal Data Selection menu will result in the frame display shown in Fig. A-11. The stored slot number (S0 to S99) contained in the 8 slots (0 to 7) making up a frame is displayed. Any frame number can be

selected and displayed using the *[Frame Number]* key followed by a one or two digit number and terminated with the [enter] key.

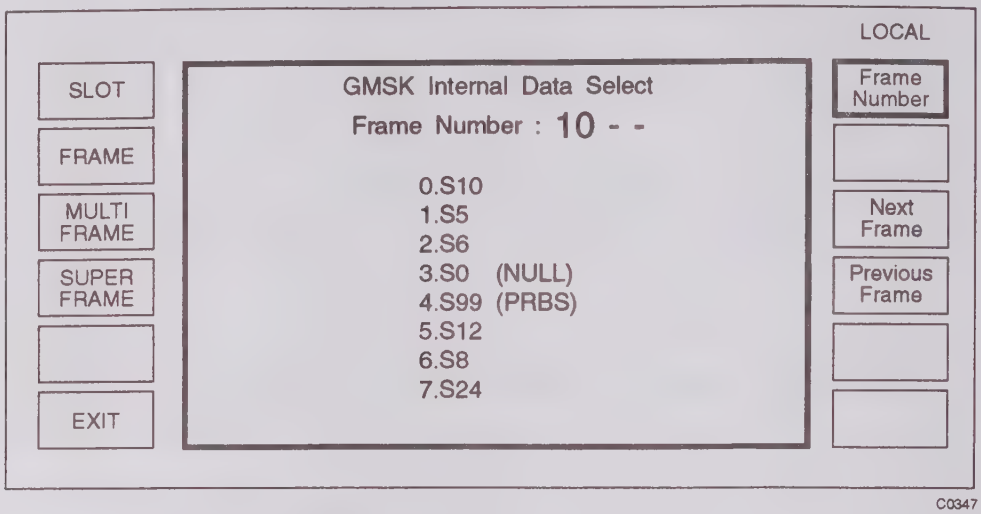


Fig. A-11 GMSK internal data select menu with frame selected

If *[MULTI FRAME]* is selected the data is displayed as shown in Fig. A-12. The multiframe data is shown as 26 frames (0 to 25) and the frame selected in each location is displayed (F0 to F99). Different multiframes can be selected using the *[Frame Number]* key.

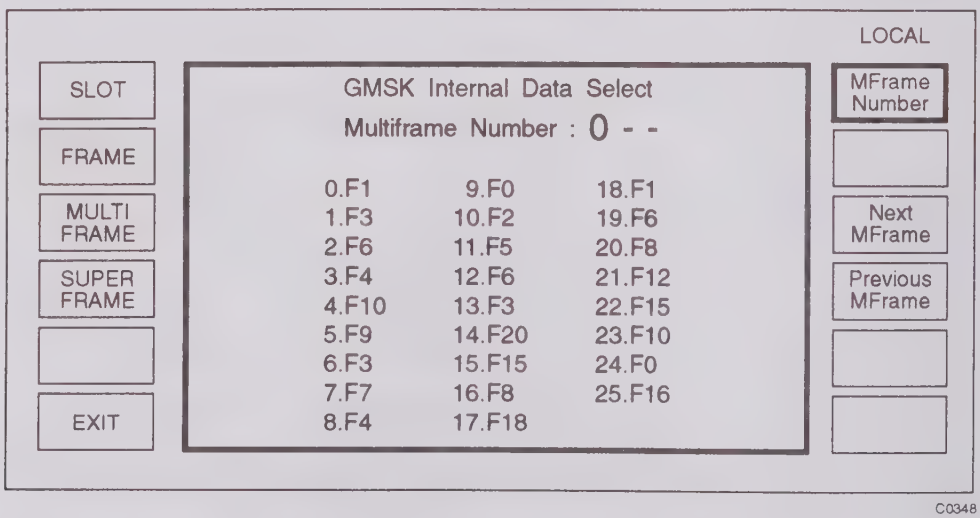


Fig. A-12 GMSK internal data select menu with multiframe selected

If *[SUPER FRAME]* is selected the data is displayed as shown in Fig. A-13. A superframe of 51 multiframes (0 to 40) is displayed with the multiframe data (MF0 to MF99) in each location.

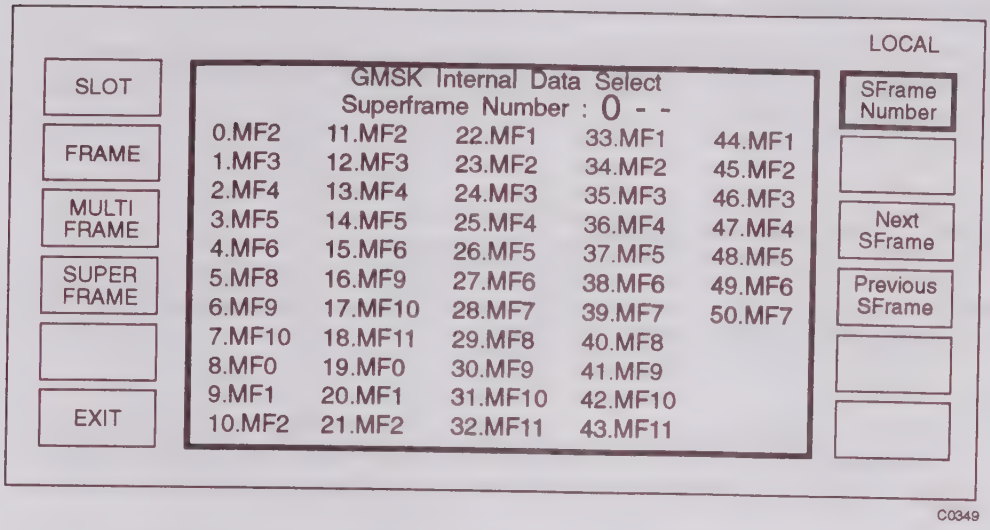


Fig. A-13 GMSK internal data selection menu with superframe selected

When the required data has been selected, selecting the *[EXIT]* key will return to the GMSK Control Menu and selecting *[Generate GMSK]* will result in the instrument generating the selected GMSK data. On selecting *[Generate GMSK]* the key will be replaced by a *[Halt GMSK]* key and selecting this key will stop GMSK generation.

Alternatively to display the carrier frequency and RF level when the data has been selected, press [SIG GEN]. The instrument display will be as shown in Fig. A-14. Selecting *[Generate GMSK]* will result in the instrument generating the selected GMSK data.

The carrier frequency and level can be entered from the Sig. Gen. Menu with internal data selected in the same way as with an external data source (see page A-13).

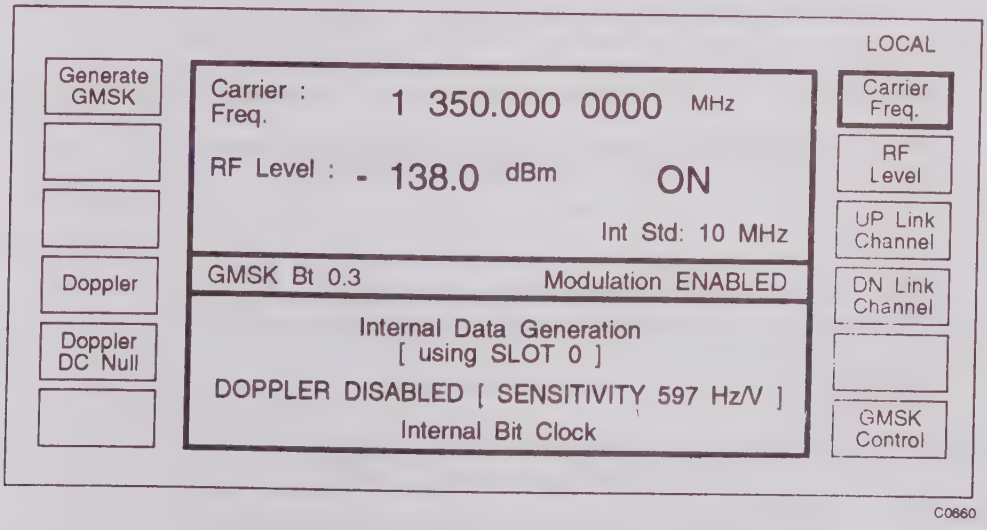


Fig. A-14 Sig. Gen. menu with internal data selected

Modulation ON/OFF

Pressing of the [MOD ON-OFF] key underneath the display will enable or disable the GMSK modulation. When modulation is disabled the generator reverts to normal mode and the GMSK module is bypassed.

External Clock/Internal Data

The internal data generator can be used with an external clock with the same format clock as described under 'External Data/Clock Operation'. To select an external clock press *[Int/Ext Bit Clk]* on the GMSK Control Menu (see Fig. A-9).

Notes...

In order to operate from an external bit clock, the configuration control (see 'Configuration control' above) must be set to either stand alone or slave mode. In master mode a bit clock output is generated on the CLOCK connector.

If external clock is selected but not applied, no error message is displayed.

DATA EDITOR

The data in a slot, frame, multiframe or superframe can be edited with the editor. To edit data select *[Edit Int Data]* on the GMSK Control Menu in Fig. A-9. The operating principle of the editor is similar whichever data (slot, frame, multiframe or superframe) is being edited. The data is displayed in the same format as shown under 'Internal Data Selection'. If a slot is being edited the data is displayed as shown in Fig. A-15. Having selected the data to be edited pressing the *[EDIT]* key will result in the display shown in Fig. A-16. A cursor box will appear in the position which is to be edited. Selecting *[Set Bit to 0]* or *[Set Bit to 1]* will enter a 0 or 1 at that point and the cursor will then automatically increment to the next bit. The cursor position can be moved by selecting *[Bit Number]* followed by a one to three digit number then pressing the [enter] key. *[Next Bit]*, *[Previous Bit]* can be used to increment or decrement the cursor position.

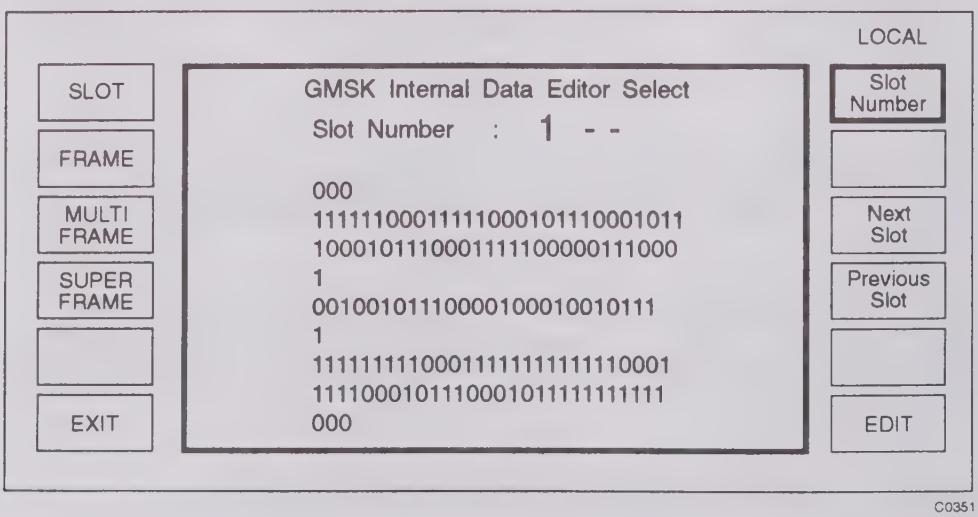


Fig. A-15 Data editor with slot editing selected

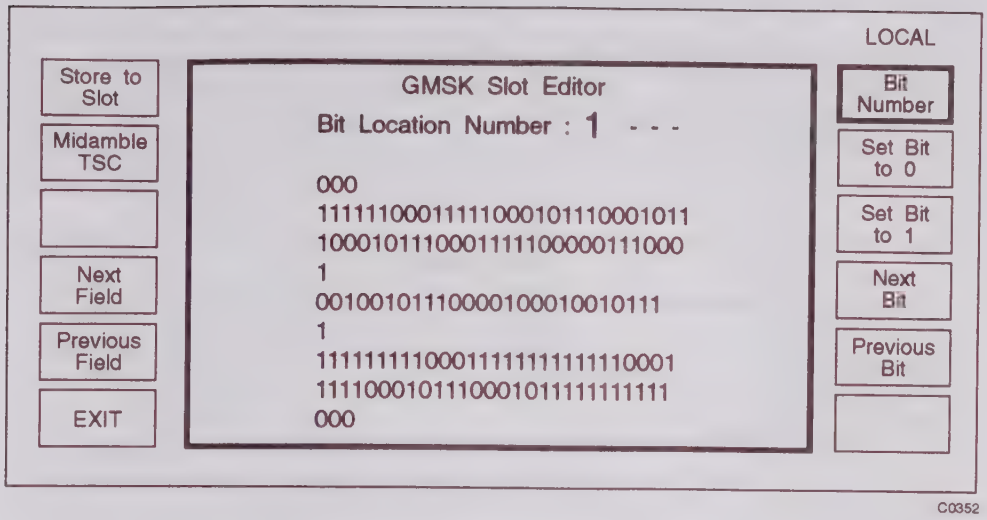


Fig. A-16 Editing slot data

The midamble training sequence (Midamble TSC) can be directly entered by selecting *[Midamble TSC]* followed by a number (0 to 7 as defined in the GSM standard) then pressing the [enter] key.

The cursor position can also be changed to the start of a field by using the *[Next Field], [Previous Field]* keys. The fields are defined as the first tail bits, first data field, first control bit, midamble, second control bit, second data field, and final tail bits. The guard bits are not programmable and are set to 1.

When the data has been edited selecting *[Store to Slot]* followed by a one or two digit number and then pressing the [enter] key will result in the data being stored to the appropriate slot number (S1 to S98).

It should be noted that slots S0 and S99 are pre-defined slots and cannot be edited. S0 is defined as a NULL slot and S99 as a pseudo random bit sequence (PRBS) corresponding to that required of the GSM standard.

To return to the GMSK Internal Data Editor Select menu select the *[EXIT]* key.

Frame editor

Selecting *[FRAME]* on the GMSK Internal Data Editor will result in the display shown in Fig. A-17. The slot position being edited is displayed as S-- and the location and data are displayed at the top of the page. The location to be edited can be entered using *[Location Number]* and the data at that point can be entered after selecting *[Location Data]*.

The edited data can be stored to any frame number by selecting the *[Store to Frame]* key followed by a one or two digit number then pressing the [enter] key.

To return to GMSK Internal Data Editor Menu select *[EXIT]*.

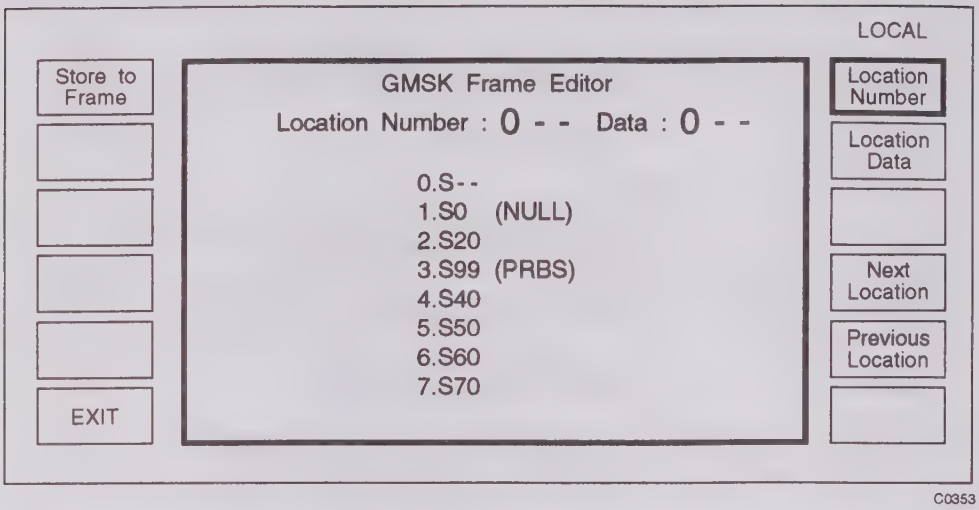


Fig. A-17 GMSK frame editor menu

Multiframe/superframe editor

Editing multiframes and superframes is accomplished in the same way as editing frames. The data is displayed in a similar format to that shown in Fig. A-12 and Fig. A-13. Information is stored in the same way as for frames. Multiframes can be stored as Multi Frame (MF) 0 to 99 and superframes as Super Frame (SF) 0 to 39.

FREQUENCY STANDARD

Instruments with the GSM option fitted can either accept a frequency standard of 13 MHz from an external source or generate a 13 MHz standard via the FREQ STD INT/EXT connector on the rear panel in addition to those available on other versions of the 2030 series. Selection is via the Utilities page 1 using the *[Int/Ext Standard]* key

The output frequency of the GSM signal is the sum of the local oscillator frequency and the 3.25 MHz IF carrying the modulation. The local oscillator and 3.25 MHz IF are locked in accordance with Table A-1 below

TABLE A-1 FREQUENCY LOCKING

INT/EXT STD set to:	Bit clock set to:	2030 local oscillator locked to:	3.25 MHz IF locked to:	INT STD O/P locked to:
INT	INT	Internal OCXO	Internal OCXO	Internal OCXO
INT 1, 5 or 10 MHz	EXT	Internal OCXO	Bit clock	Internal OCXO
INT 13 MHz	EXT	Internal OCXO	Bit clock	Bit clock
EXT	INT	External std	External std	N/A
EXT	EXT	External std	Bit clock	N/A

POWER UP OPTIONS

In some circumstances it may be desirable for the instrument to switch on with a GMSK signal being generated. To set an instrument to recall to GMSK setting on power up select the Utilities 2 Menu. Unlock the instrument using *[Lock & Unlock]* key to Level 1. The default password for Level 1 is 1234 (see page 3-1-36). Return to the Utilities 2 Menu and select the *[Power Up Option]* key to obtain the menu shown in Fig. A-18 when *[Memory Power Up]* is selected.

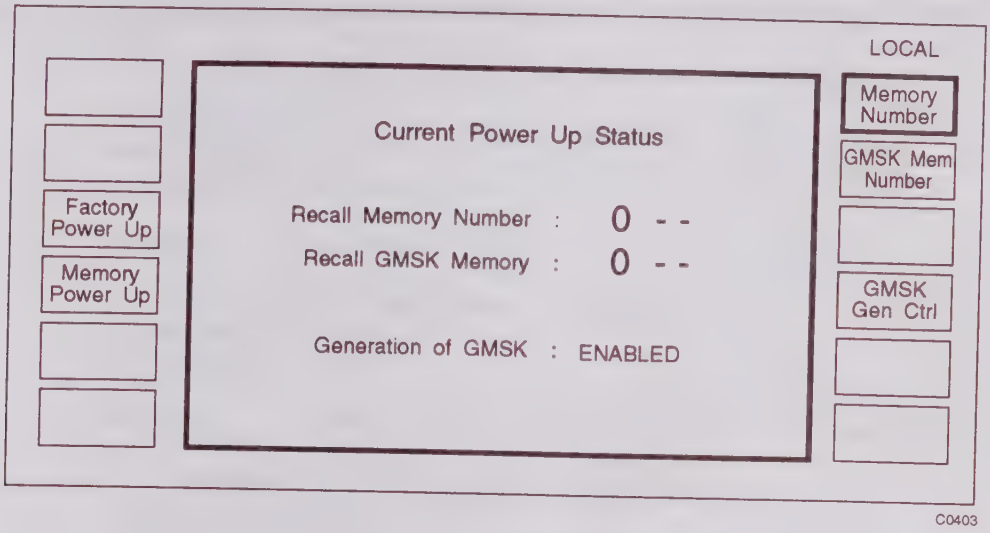


Fig. A-18 Power up options menu with memory power up selected

The default (maximum frequency, minimum level) *Factory Power Up* or a *Memory Power Up* can be selected. If a *Memory Power Up* is selected the signal generator setting is selected by defining the *Memory Number* (which sets carrier frequency, level, modulation mode etc.) and the GMSK memory to be recalled (see page A-13). The *[GMSK Gen Ctrl]* key can be used to set the generator to generate GMSK at power up if it is ENABLED and the modulation mode is GMSK.

ERROR HANDLING

Errors may be divided into three groups - foreground errors generally caused by a user, background errors which represent a condition of the instrument and GPIB errors which occur only when the unit is being controlled by a GPIB controller. Foreground and background errors specific to GMSK operation are shown in Tables A-2 and A-3 respectively.

ERROR MESSAGES

TABLE A-2 FOREGROUND ERRORS

Error		Descriptive text	Error		Descriptive text
No.	Type		No.	Type	
93	exe	DSP Not Responding	151	exe	Illegal Slot Data
94	dde	GMSK Data Checksum	152	exe	Incorrect GMSK Data Type
149	exe	GMSK Parameter Unknown	153	exe	Incorrect Data Length
150	exe	Wrong LF units			

TABLE A-3 BACKGROUND ERRORS

Error		Descriptive text	Error		Descriptive text
No.	Type		No.	Type	
39	dde	GMSK Calibration Checksum	44	dde	No 13 MHz Standard
42	exe	RF Level limited by GMSK	45	exe	Carr., limited by GMSK
43	dde	No external bit clock			

GPIB OPERATION

The following GPIB Mnemonics are used to control the GMSK Bt 0.3 option in addition to those described in Chapter 3-2. But note that the external hysteresis commands HYST and HYST? have no effect.

ADDITIONAL COMMANDS

GMSK [not used alone]

:DSOURCE [not used alone]

:SLOT Select the data source to be internal slot 0-99

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

:FRAME Select the data source to be internal slot 0-99

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

:MFRAME Select the data source to be internal multiframe 0-99

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

:SFRAME Select the data source to be internal superframe 0-39

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

:EXTERNAL Select the data source to be external

Data type : None
Allowed suffices : None
Default suffix : None

:CLOCK Select bit clock control for internal data (master/stand alone configurations)

Data type : Character program data (either INTERNAL or EXTERNAL)
Allowed suffices : None
Default suffix : None

:MODOPT [not used alone]

:SBAND Select sideband control

Data type: Character program data (any one of : UPPER, LOWER or AUTO)
Allowed suffices : None
Default suffix : None

:MODPOL Select modulation polarity control

Data type : Character program data (either NORMAL or INVERSE)
Allowed suffices : None
Default suffix : None

:FIDELITY Bt selection control

Data type : Character program data (either NORMAL or CORRUPT)
Allowed suffices : None
Default suffix : None

:ENCODING Select differential data encoding control

Data type : Character program data (either DISABLED or ENABLED)
Allowed suffices : None
Default suffix : None

:ENVELOPE Select envelope control

Data type : Character program data (either CONT or DISCONT)
Allowed suffices : None
Default suffix : None

:CTRL [not used alone]

:TRIGGER Select whether the internal data is generated in single shot or continuous operation

Data type: Character program data (either SNGL or CONT)
Allowed suffices : None
Default suffix : None

:CONFIG Select system configuration

Data type: Character program data (any one of : MASTER, SLAVE or S_ALONE)
Allowed suffices : None
Default suffix : None

:DOPPLER Select doppler control

Data type: Character program data (either DISABLED or ENABLED)
Allowed suffices : None
Default suffix : None

:START Start GMSK internal data generation

Data type: None
Allowed suffices : None
Default suffix : None

:STOP Stop GMSK internal data generation

Data type: None
Allowed suffices : None
Default suffix : None

:TEST
:WFORM [not used alone]
GMSK test utility. Select test waveform 0-7 for generation (must set IMODE CAL first)

Data type: Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

:ABORT Exit the test suite

Data type: None
Allowed suffices : None
Default suffix : None

GMSK:DSOURCE? Prepares message containing information on the data source selected

Examples:
```
:GMSK:DSOURCE:EXTERNAL
:GMSK:DSOURCE:FRAME 6
```

GMSK:CLOCK? Prepares message containing information on the bit clock currently in use.

Example:
```
:GMSK:CLOCK INTERNAL
```

GMSK:MODOPT? Prepares message containing information on GMSK modulation control settings in the following format:

:GMSK:MODOPT:SBAND<status>;MODPOL<status>;FIDELITY <status>;ENCODING<status>;ENVELOPE<status>

where: <status> is character program data for the specified mnemonic.

Example:
```
:GMSK:MODOPT:SBAND AUTO;MODPOL INVERSE;FIDELITY
NORMAL;ENCODING DISABLED;ENVELOPE CONT
```

GMSK:CTRL? Prepares message containing information on the GMSK main control settings in the following format:

:GMSK:CTRL:TRIGGER<status>;CONFIG<status>;DOPPLER<status>;

where: <status> is character program data for the specified mnemonic.

Example:
```
:GMSK:MODOPT:SBAND AUTO;MODPOL INVERSE;FIDELITY
NORMAL;ENCODING DISABLED;ENVELOPE CONT
```

SLOT
:LOAD [not used alone]
Load slot data into the GMSK editor. All 148 bits must be entered

Data type : String program data consisting of 148 characters from 0 to 1 between string delimiters
Allowed suffices : None
Default suffix : None

:SAVE Save slot data to the requested slot number (1-98)

Data type: Decimal numeric program data
Allowed suffices : None
Default suffix : None

SLOT? Prepares message containing information on the contents of the slot requested in the following format:

:SLOT:LOAD<slot data>;

where: <slot data> is string program data defining the controls of the slot requested.

Data type: Decimal numeric program data
Allowed suffices : None
Default suffix : None

Example: `:SLOT:LOAD "100010001000....111110"`

FRAME [not used alone]
:LOAD Load frame data into the GMSK editor. All 8 slot values must be entered

Data type : Multiple decimal numeric program data
Allowed suffices : None
Default suffix : None

:SAVE Save frame data to the requested frame number (0-99)

Data type: Decimal numeric program data
Allowed suffices : None
Default suffix : None

FRAME? Prepares message containing information on the contents of the frame requested in the following format

:FRAME:LOAD:<frame data>

where: <frame data> is multiple decimal numeric program data defining the contents of the frame requested.

Data type: Decimal numeric program data
Allowed suffices : None
Default suffix : None

Example: `:FRAME:LOAD 34,6,15,99,0,22,44,76`

MFRAME [not used alone]
:LOAD Load multiframe data into the GMSK editor. All 26 frame values must be entered

Data type : Multiple decimal numeric program data
Allowed suffices : None
Default suffix : None

:SAVE Save multiframe data to the requested multiframe value (0-99)

Data type: Decimal numeric program data
Allowed suffices : None
Default suffix : None

MFRAME? Prepares message containing information on the contents of the multiframe requested in the following format

:MFRAME:LOAD:<mframe data>

where: <mframe data> is multiple decimal numeric program data defining the contents of the multiframe requested.

Data type: Decimal numeric program data
Allowed suffices : None
Default suffix : None

Example: `:MFRAME:LOAD 56,78,92,22,....12,0,5`

SFRAME
:LOAD [not used alone]
Load superframe data into the GMSK editor. All 51 multiframe values must be entered

Data type : Multiple decimal numeric program data
Allowed suffices : None
Default suffix : None

:SAVE Save superframe data to the requested multiframe value (0-39)

Data type: Multiple decimal numeric program data
Allowed suffices : None
Default suffix : None

SFRAME? Prepares message containing information on the contents of the superframe requested in the following format

:SFRAME:LOAD:<sframe data>

where: <sframe data> is multiple decimal numeric program data defining the contents of the superframe requested.

Data type: Decimal numeric program data
Allowed suffices : None
Default suffix : None

Example: `:SFRAME:LOAD 44,87,29,7,....77,65,1`

MODULATION MODE

MODE Set modulation mode

Data type : Character Program Data (valid combinations of AM, AM1, AM2, FM, FM1, FM2, GMSK, PM, PM1, PM2, WBFM or PULSE, see Table below)
Allowed suffices : None
Default suffix : None

Examples:
```
MODE AM,FM
MODE FM1,FM2
```

VALID MODE COMBINATIONS TABLE

Single	Composite	Dual	Dual Composite	GMSK
AM1	AM1,AM2	AM1,FM1	AM1,AM2,FM1,FM2	GMSK
FM1	FM1,FM2	AM1,PM1	AM1,AM2,PM1,PM2	
PM1	PM1,PM2	AM1,WBFM	AM1,AM2,WBFM	
WBFM		PULSE,FM1	PULSE,FM1,FM2	
PULSE		PULSE,PM1	PULSE,PM1,PM2	
		PULSE,WBFM		

Note...

At any time the '1' may be omitted, for example FM is equivalent to FM1. Order is not important, for example AM,FM is equivalent to FM,AM.

MODE? Prepares message containing information on Modulation Mode in the following format:

:MODE:<mode>

where: <mode> is character program data indicating the modulation mode settings.

Example:
```
:MODE FM1,FM2
```

MEMORY - STORE

STO	[not used alone]
:FULL	Full Store 0-49
:PART	Partial Store 0-49
:CFRQ	Carrier Freq Store 0-99
:SEQT	Sequential Tones Store 0-19
:SWEEP	Sweep Store 0-19
:GMSK	GMSK store 0-19

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

Examples:
```
:STO:FULL 17
:STO:CFRQ 83
```

MEMORY - RECALL

RCL	[not used alone]
:FULL	Recall Full 0-49
:FXCF	Recall Full 0-49 (without carrier frequency)
:PART	Recall Partial 0-49
:RXCF	Recall Partial 0-49 (without carrier frequency)
:CFRQ	Recall Carrier Freq 0-99
:SEQT	Recall Sequential Tones Sequence 0-19
:SWEEP	Recall Sweep 0-19
:GMSK	Recall GMSK Store 0-19

Data type : Decimal Numeric Program Data
Allowed suffices : None
Default suffix : None

Examples:
```
:RCL:FULL 15
:RCL:CFRQ 75
```

MEMORY - ERASE

ERASE	[not used alone]
:FULL	Erase all Full Stores
:PART	Erase all Partial Stores
:CFRQ	Erase all Carrier Freq Stores
:SEQT	Erase all Sequential Tones Stores
:SWEEP	Erase all Sweep Stores
:GMSK	Erase all GMSK Stores
:ALL	Erase all Stores

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
:ERASE:FULL 12
:ERASE:ALL
```

MISCELLANEOUS COMMANDS

FSTD Select internal or external frequency standard

Data type : Character program data (any one of INT1, INT5, INT10, EXT1, EXT5 or EXT10, INT13, EXT13 (0ption 005 fitted))
Allowed suffices : None
Default suffix : None

Examples:
```
INT10
EXT5
```

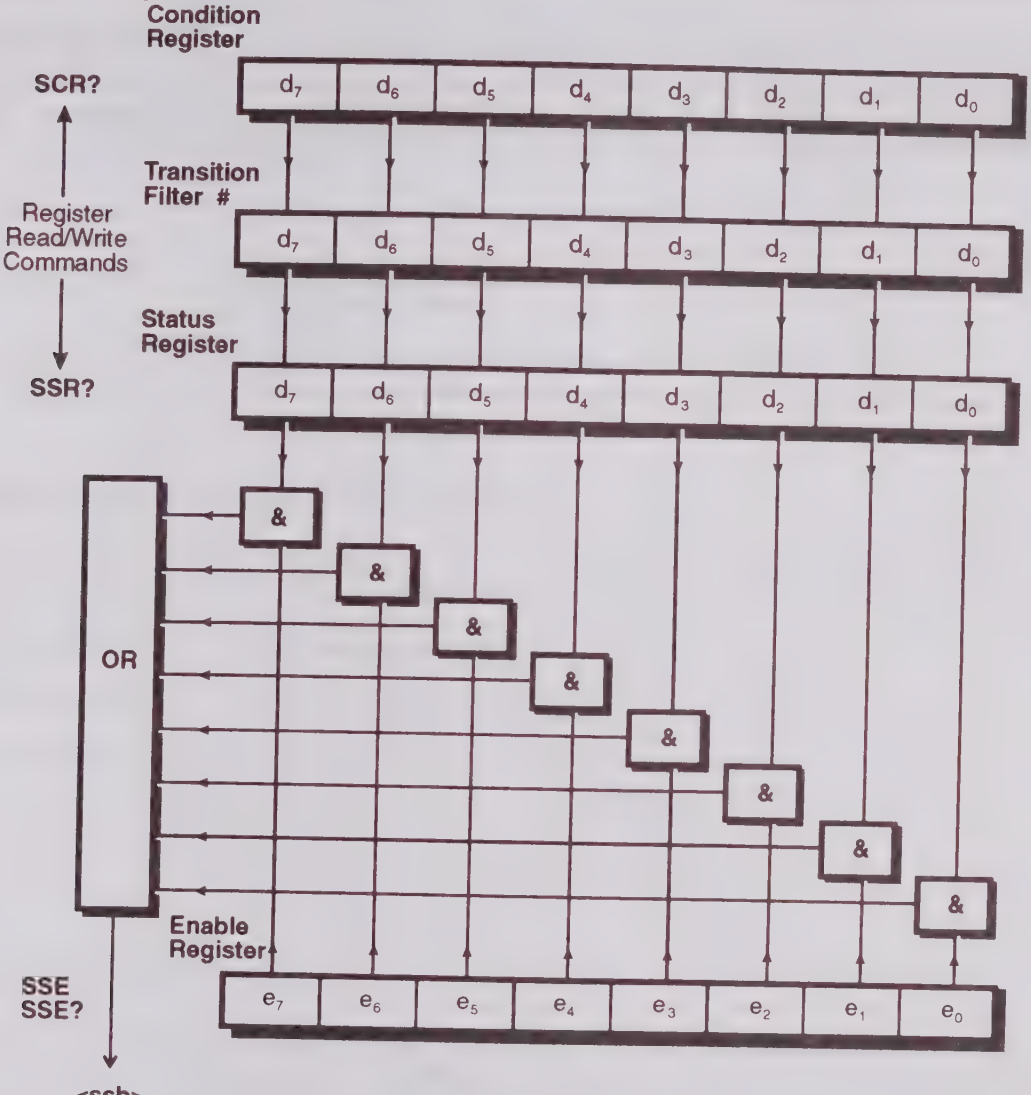
FSTD? Prepares message containing information on frequency standard selection in the format:

:FSTD <char>

Example:
```
:FSTD EXT10
```

INSTRUMENT EVENT REGISTERS

This is a device dependant Register and the bits have meanings as shown in the list at the bottom of the page.



 # Negative transition sets status.

C0071

Condition (*SCR?)		Event Status (*SSR?)
d	sweep in progress	end of sweep
d_0	sending tones	tones sent
d_1	selfcal in progress	selfcal completed
d_2	dc fm null in progress	dc fm null completed
d_3	generating GMSK	GMSK generation suspended
d_4	not used	not used
d_5	not used	not used
d_6	not used	not used
d_7		

<ssb> instrument event register summary bit

ACCEPTANCE TESTING

INTRODUCTION

The test procedures in this section enable you to verify that the electrical performance of the signal generator complies with the Performance Data given in earlier. The test equipment recommended for this purpose is listed in Table A-4. All tests may be performed with the covers in place and are intended to be carried out in the order given. For convenience, the test equipment and specification for each test are summarized before the test procedure.

TABLE A-4 RECOMMENDED TEST EQUIPMENT

Description	Minimum specification	Example
Spectrum analyzer	10 MHz to 2 GHz Level accuracy ±1 dB	Marconi 2383
DVM	DC accuracy ±0.01 V	Solatron 7150 +
DC power supply	0 V to 5 V	Weir 413D
GMSK analyzer	Measurement of GMSK Bt 0.3 modulation	Arane AR 9000
Signal generator	Frequency range up to 15 MHz. Output level +13 dBm.	Marconi 2030
Counter	Measurement range up to 15 MHz	Marconi 2435

GMSK Bt 0.3 MODULATION FIDELITY

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
GMSK analyzer	Measurement of GMSK Bt 0.3 modulation	Arane AR 9000

(1) Connect the UUT to the GMSK analyzer.

(2) Use the GMSK analyzer to ensure that the UUT is within its specification.

RF LEVEL ACCURACY

SPECIFICATION
RF level accuracy ±2 dB

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Spectrum analyzer	10 MHz to 2 GHz Level accuracy ±1.5 dB	Marconi 2383

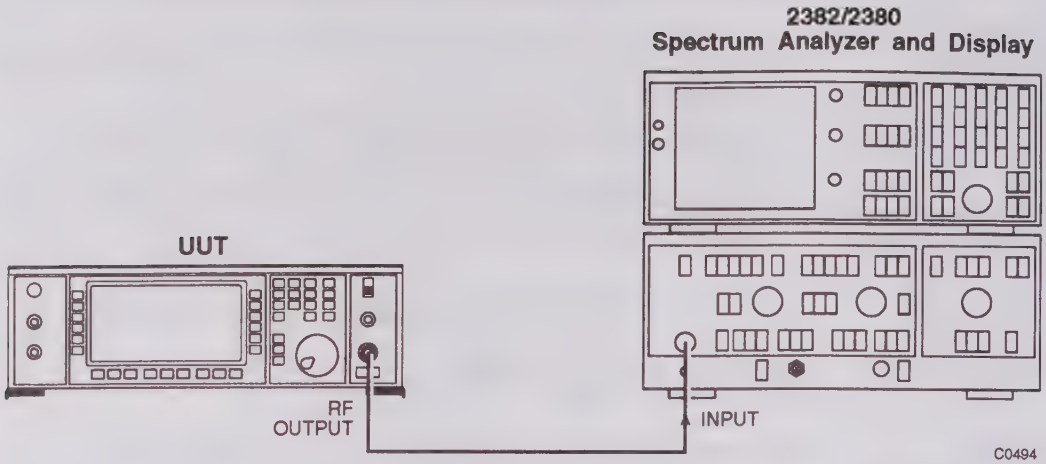


Fig. A-19 RF level test set-up

(1) Connect the test equipment as shown in Fig. A-19.

(2) Obtain a set of calibrated levels for the spectrum analyzer using the following procedure:-

Preset and calibrate	
Reference level	0 dBm
Span/div	50 kHz
Single sweep	

Set the UUT as follows:-

[Carrier Freq]	as detailed in Table A-5
[RF Level]	-10 dBm
[MOD]	off

Tune the spectrum analyzer to the same frequency as the UUT. Take a sweep on the spectrum analyzer and use the marker peak find to measure the signal amplitude. Note this as the **calibrated level.** Repeat for all the frequencies in Table A-5.

(3) Set the UUT to:-

[Carrier Freq]	10 MHz
[RF Level]	-10.0 dBm
[UTIL]*[Mod'n Mode]*[*GMSK*]f	

[UTIL] *[Menu 2] [Latch Data] [Latch Number]* 103 [enter]*[Latch Data]* 152 [enter]

This selects test waveform 0 which is a single tone at the selected frequency and level.

(4) Check that the output level error with respect to the calibrated level is within specification.

(5) Repeat (3) and (4) above for the frequencies shown in Table A-5.

TABLE A-5 RF LEVEL TEST FREQUENCIES

Reference Frequency	Measured cal level	Measured level	Calculated error
10.00			
56.25			
131.25			
206.25			
356.25			
431.25			
506.25			
581.25			
656.25			
731.25			
806.25			
881.25			
956.25			
1031.25			
1106.25			
1181.25			
1256.25			
1331.25			
2031 Only			
1406.25			
1481.25			
1556.25			
1631.25			
1706.25			
1781.25			
1856.25			
1931.25			
2000.00			

PHASE ACCURACY

SPECIFICATION
Phase accuracy as defined by GSM 05.05 - 4.6 is 1 degree RMS, 3 degrees peak.
Note... An indirect method of measuring the phase accuracy is used. This uses built-in test waveforms which when analyzed give an indication to the size of the phase error introduced by the modulation process.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Spectrum analyzer	10 MHz to 2 GHz Level accuracy ±2 dB	Marconi 2383

(1) Connect the test equipment as shown in Fig. A-19.

(2) Set the UUT as follows :-

[Carrier Freq]	100 MHz
[RF Level]	-20 dBm
[UTIL]*[Mod Mode] [GMSK]*	
[MOD]	On

(3) On the UUT built-in test waveform 1 can be selected by either :-

[UTIL] *[Menu 2] [Latch Data] [Latch Number]* 103 [enter] *[Latch Data]* 153 [enter]

or:

Unlock the UUT to Level 2. Then select :-

[UTIL] *[Cal Vals][GMSK] [Test W'forms] [Waveform Number]* 1 [enter]

Test waveform 1 is a carrier modulated with 15 tones each spaced about 102 kHz apart.

(4) Set the spectrum analyzer up as follows :-

Preset and calibrate	
Reference frequency	100 MHz
Span/div	200 kHz
Reference level	- 20 dB
Single sweep.	

Take a sweep on the spectrum analyzer. The display should be similar to Fig. A-20.

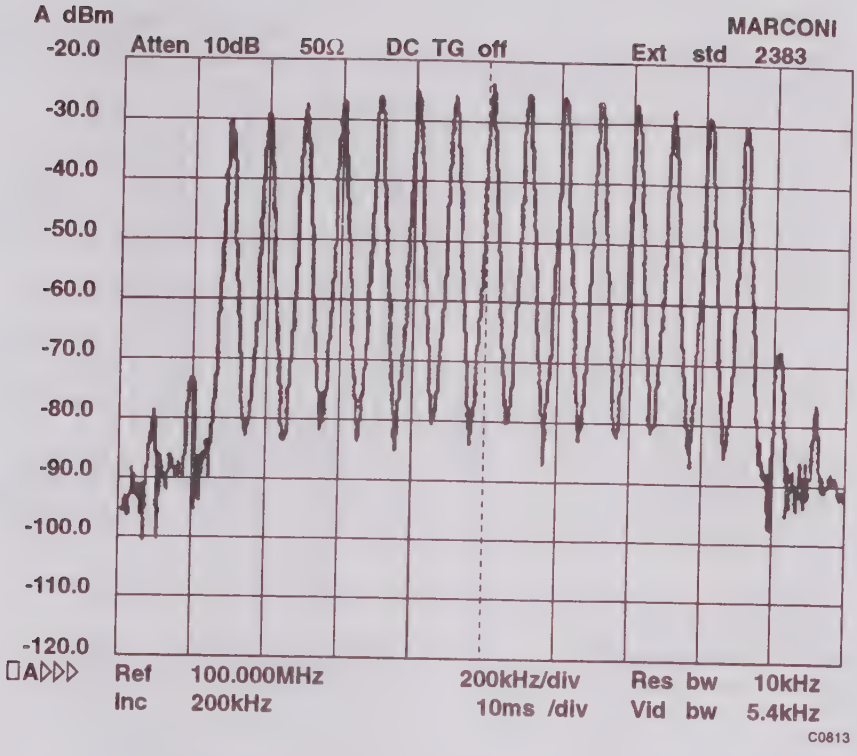


Fig. A-20 Spectrum of built-in test waveform 1

On the trace check that :-

(a) All 15 of the test tones are visible.

(b) There are no noticeable spurious signals.

(c) The shape of the complete spectrum is symmetrical.

(5) Using the marker note the position and location of the third, sixth, tenth and thirteenth tones (counting from the left). See Table A-6.

(6) Select waveform 2 as follows :-

[UTIL] *[Menu 2] [Latch Data] [Latch Number]* 103 [enter]*[lLatch Data]* 154 [enter]

or :-

Unlock the UUT to Level 2. Then select :-

[UTIL] *[Cal Vals] [GMSK] [Test W'forms] [Waveform Number]* 2 [enter]

Test waveform 2 is similar to test waveform 1, but 4 of the tones have been suppressed. The suppressed tones are the third, sixth, tenth and thirteenth tones (counting from the left).

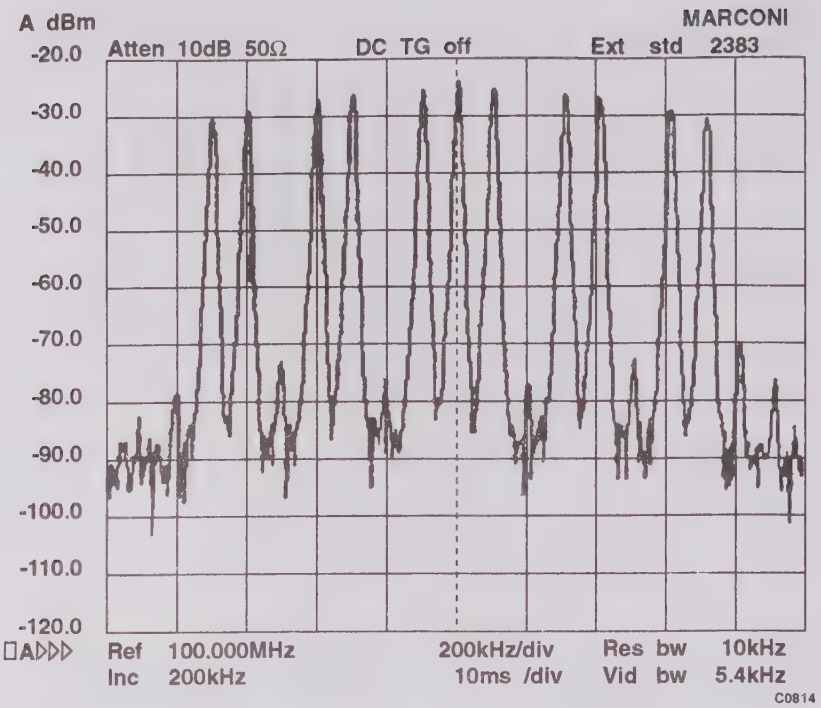


Fig. A-21 Spectrum of built-in test waveform 2

(7) On the spectrum analyzer take a sweep. The displayed spectrum should be similar to the spectrum shown in Fig. A-21.

(8) Tune the spectrum analyzer to the frequency of the 3rd tone and set :-

Span/div	1 kHz
Video average	8 sweeps
Marker peak find	

The marker gives the level of the suppressed tone. Ensure that the measured level is at least -40 dBc with respect to the original level.

(9) Repeat (8) for the sixth, tenth and thirteenth tones.

TABLE A-6 SUPPRESSED LEVELS FOR WAVEFORM 2

Tone	Frequency	Ref level	Suppressed level
3rd	_____	_____	_____
6th	_____	_____	_____
10th	_____	_____	_____
13th	_____	_____	_____

Note...

The level of the suppressed tone is proportional to the amount of distortion which is introduced during the analogue signal processing. A measured level of -40 dBc would represent a worst case phase error of 0.15 degrees RMS.

OFF SLOT SUPPRESSION

SPECIFICATION
Better than - 70 dBc at 0 V

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Spectrum analyzer	10 MHZ to 2 GHz Level accuracy ±2 dB	Marconi 2383
DVM	DC accuracy ±0.01 V	Solatron 7150 +
DC power supply	Range 0 V to 5 V	Weir 413D

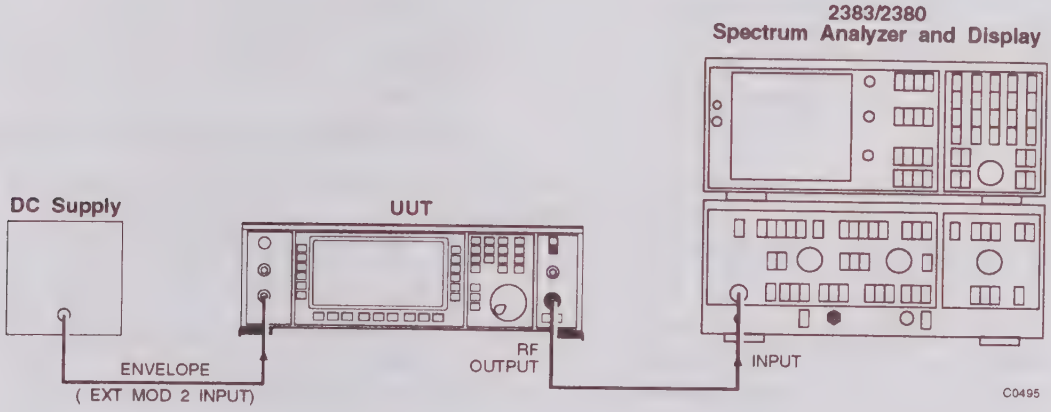


Fig. A-22 Off slot suppression test set-up

(1) Set the UUT as follows :-

[Carrier Freq] 100 MHz
[RF Level] 0 dBm
[UTIL] *[Mod'n Mode] [GMSK]*
[SIG GEN]

[GMSK Control] [Int/Ext Data] select ext data

Ignore the internal standard error which is displayed.

[GMSK Control] [Config Select]

Ensure that the control page is set up as follows :-

Trigger Control	*Continuous*
Configure Control	*Stand Alone*
Doppler	*Disabled*
Sideband	*Upper*
Mod polarity	*Normal*
GMSK Fidelity	*Normal*
Diff Encoding	*Enabled*
Envelope Control	*Discontinuous*

(2) Connect the DC source to the DVM and adjust the voltage until the DVM reads 1 ±0.02 V

(3) Connect the DC source to the ENVELOPE socket (EXT MOD 2 INPUT) as shown in Fig. A-22.

(4) Set the spectrum analyzer as follows:-

Ref frequency	100 MHz
RF level	0 dBm
Span/div	200 kHz
Sweep time/div	200 ms
Sweep mode	single sweep

Take a sweep on the spectrum analyzer and use the marker to measure the peak amplitude. Note this as a reference level.

(5) Set the DC power supply to 0 V.

(6) Take a sweep on the spectrum analyzer. Use the marker to measure peak level.

Ensure that the measured level is -70 dBc with respect to the reference level.

FREQUENCY STANDARD

SPECIFICATION
In GMSK mode an input or output at 13 MHz is available.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Signal generator	Freq range up to 15 MHz. Output level +13 dBm	Marconi 2030
Counter	Frequency range up to 15 MHz	Marconi 2435

Output frequency check

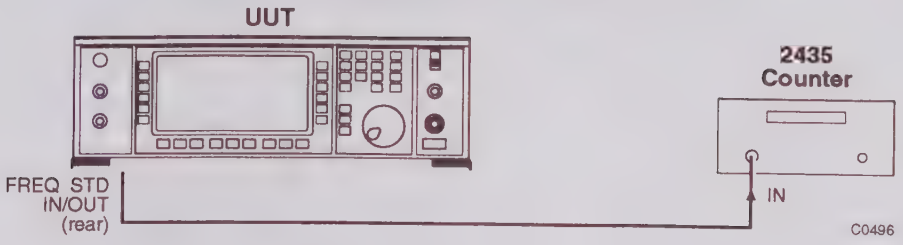


Fig. A-23 Frequency standard output test set-up

(1) Connect the test equipment as shown in Fig. A-23.

(2) Set the UUT as follows :-

[UTIL] *[Mod'n Mode] [GMSK]*
[UTIL] *[Freq Std] [Int 13 MHz]*

(3) Ensure that the frequency measured on the counter is 13 MHz ±3 Hz.

Frequency standard locking test

Fig. A-24 Frequency standard locking test set-up.

(1) Set the UUT as follows :-

[UTIL] *[Mod'n Mode] [GMSK]*
[UTIL] *[Freq Std] [Ext 13 MHz]*

(2) Ensure that UUT displays *No 13 MHz Standard* or *VCXO Out of Lock.*

(3) Connect the test equipment as shown in Fig. A-24.

(4) Set the signal generator as follows :-

Carrier freq	13 MHz
RF level	13 dBm

(5) Ensure that the external standard error is removed.

Blank Page

Annex B
OPTION 006 AVIONICS

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GENERAL DESCRIPTION

This option provides internal generation of waveforms suitable for testing Instrument Landing Systems (ILS) and VHF Omnidirectional Radio Range (VOR) systems. Option 006 requires Option 001 (Second Modulation Oscillator) to be fitted.

ILS mode

In ILS mode the SDM (Sum of Depth of Modulation) of the 90 Hz and 150 Hz tones is entered to a resolution of 0.1% AM depth. The DDM (Difference in Depth of Modulation) is entered to a resolution of 0.01% depth for a DDM up to 20% and 0.1% for higher DDM settings. A choice of which tone is dominant is available to the user. DDM is also displayed in μA, to a resolution of 0.01 μA.

The 30 Hz repetition frequency of the ILS waveform can be adjusted in 0.1 Hz steps. For 0% DDM additional modulation signals can be added to the ILS waveform.

Marker beacon mode

In marker beacon mode the outer, middle and inner beacons can be tested by simple key selection.

VOR mode

In VOR mode the AM depth of the sub-carrier and 30 Hz tone can be independently set and the relative phase of the 30 Hz tone and the modulation tone on the sub-carrier is set by directly entering the bearing information in degrees. The VOR rate repetition rate of 30 Hz can be adjusted in 0.1 Hz steps. For a fixed bearing additional modulation can be applied to simulate voice/identity signal. A *[To/From]* beacon key provides a rapid means of reversing a bearing entry and accounting for different bearing conventions.

ADF mode

The ADF mode provides a simple method of testing automatic direction finding receivers operating on carriers with amplitude modulation.

SEL-CAL mode

In SEL-CAL mode the signal generator enables selective calling tones to be generated as amplitude modulation. This facility can be used to test the aircraft operator's communication system on commercial aircraft.

PERFORMANCE DATA

The following specifications are in addition to that included in the 2030 series specification.

ILS MODE

Sum of Depth of Modulation (SDM)

Range:	0 to 99.9% in 0.1% steps representing the arithmetic sum of the individual tone depths.
Selection:	By keyboard entry of data and variation by ⇑/⇓ keys and rotary control.
Accuracy of SDM:	±2% of setting for carrier frequencies up to 400 MHz.

Difference in Depth of Modulation (DDM)

DDM can be entered in % or as a modulation index.

Range:	0 to 20% in 0.01% steps. 20 to 99.9% in 0.1% steps, limited by SDM.
Selection:	By keyboard entry of data and variation by ⇑/⇓ keys and rotary control.
Accuracy of DDM:	±0.0003 DDM ±0.02 of setting. At 0 DDM (on course) accuracy is ±0.0003 DDM (0.03% depth); At 0.155 DDM accuracy is ±0.0034 DDM (0.34% depth).
Tone frequencies:	90 Hz, 150 Hz nominal. Tone frequency may be adjusted by varying the ILS repetition rate of 30 Hz in 0.1 Hz steps. Tone frequencies maintain 3:1 and 5:1 relationships with the ILS rate.
Tone suppression:	Either tone can be suppressed.

Additional modulation:

Available for 0% DDM from an internal or external modulation source.

Frequency accuracy:	As frequency standard.

Audio output:

Available from the LF OUTPUT connector.

Accuracy of DDM:	±0.03% ±0.005 of setting. At 0 DDM (on course), accuracy is ±0.0003 DDM.

MARKER BEACON MODE

Provides default modulation of 95% AM depth on a 75 MHz carrier at the modulation rate of 400 Hz (outer beacon), 1.3 kHz (middle beacon) or 3 kHz (inner beacon). AM depth, carrier frequency and modulation frequency can be changed from the default values.

VOR MODE

9.96 kHz sub-carrier

Range: 0 to 49.9% depth in 0.1% steps.

Modulation: Frequency modulated by a 30 Hz tone with 480 Hz deviation.

30 Hz tone

Range: 0 to 49.9% depth in 0.1% steps.
Arithmetic sum of 30 Hz tone and sub-carrier AM depth are limited to 99.8%.

Selection: By keyboard entry of depth and variable by ⇑/⇓ keys and rotary control.

Bearing control: Relative phase of 30 Hz tone and sub-carrier modulation adjustable from 0° to 359.9° in 0.1° steps by entering VOR bearing. Bearing can be entered as TO or FROM the beacon.

Bearing accuracy: ±0.05°.

Additional modulation:

Available on 0° bearing from an internal or external modulation source.

AM depth accuracy: ±3% of setting ±0.5% for carrier frequencies up to 400 MHz.

Frequency: The VOR repetition frequency of 30 Hz may be varied in 0.1 Hz steps. The sub-carrier frequency and deviation maintain a fixed relationship with the VOR repetition rate.

Frequency accuracy: As frequency standard.

Audio output:

Available from the LF OUTPUT socket.

ADF MODE:

Provides default modulation of 30% AM depth on a 190 kHz carrier at 1 kHz modulation rate. AM depth, carrier frequency and modulation frequency can be changed from the default values.

SEL-CAL MODE

Provides amplitude modulation with SEL-CAL (SELective CALling) tones.

Data entry

By soft keys labelled A to S, of up to 2 pairs of characters.

Timing:

Default 1 s tone duration, 250 ms tone gap. Tone gap, duration and start delay can be changed from the default values.

AVIONICS OPERATION

This section explains how to use Option 006 when fitted to a 2030 series Signal Generator. Familiarity with the normal operation of the instrument is assumed.

The Avionics option offers modes of operation suitable for testing ILS and VOR systems. It also provides efficient testing of ADF (Automatic Direction Finders) and SEL-CAL receivers. It is assumed that the operator has some knowledge of the operation of these avionics systems.

The Avionics mode is selected by pressing the [UTIL] key and selecting the *[Mod'n Mode]* key on the Utilities 1 page shown in Fig. B-1 to obtain the menu shown in Fig. B-2. Selecting *[Avionics Mode]* from this menu will result in the Avionics mode menu shown in Fig. B-3 being displayed. Pressing the appropriate soft key will result in the instrument entering the required mode of operation; pressing *[Other modes]* returns the display to the Modulation mode selection menu.

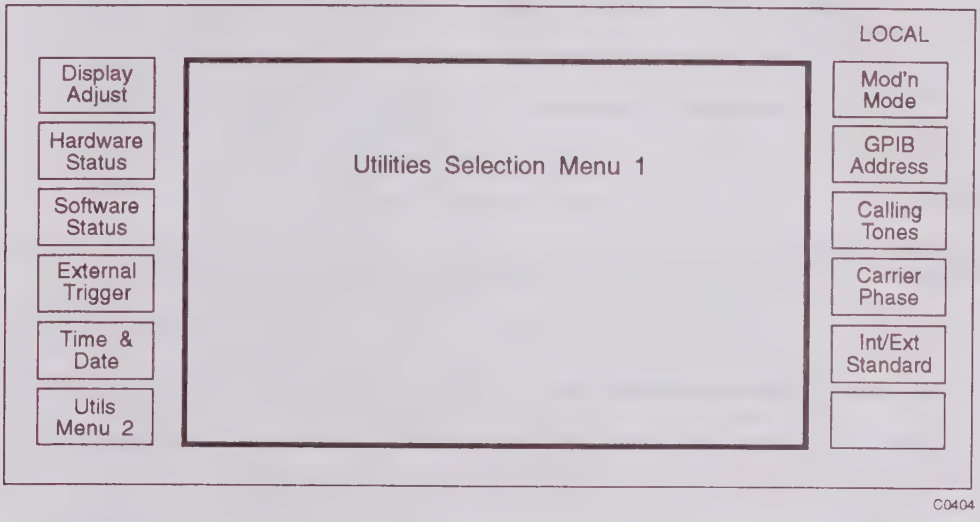

Fig. B-1 Utilities selection menu 1

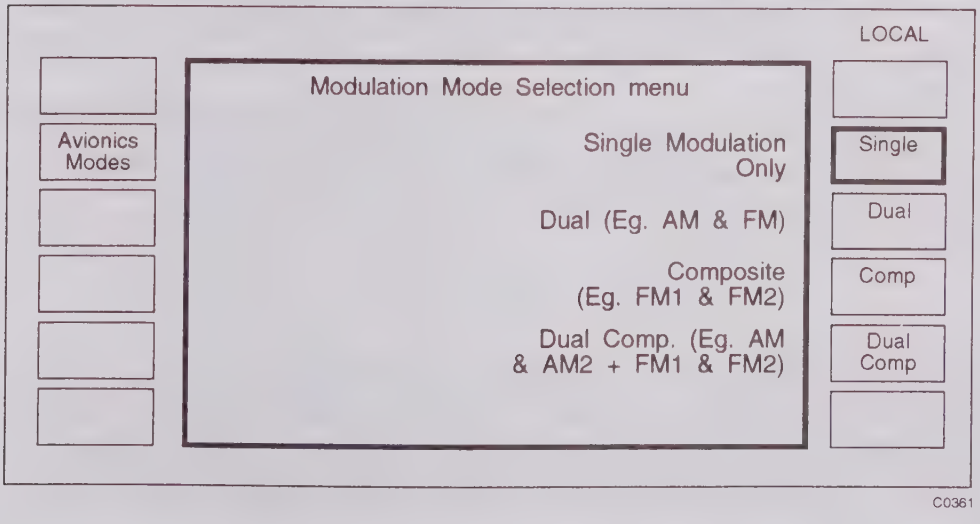

Fig. B-2 Modulation mode selection menu

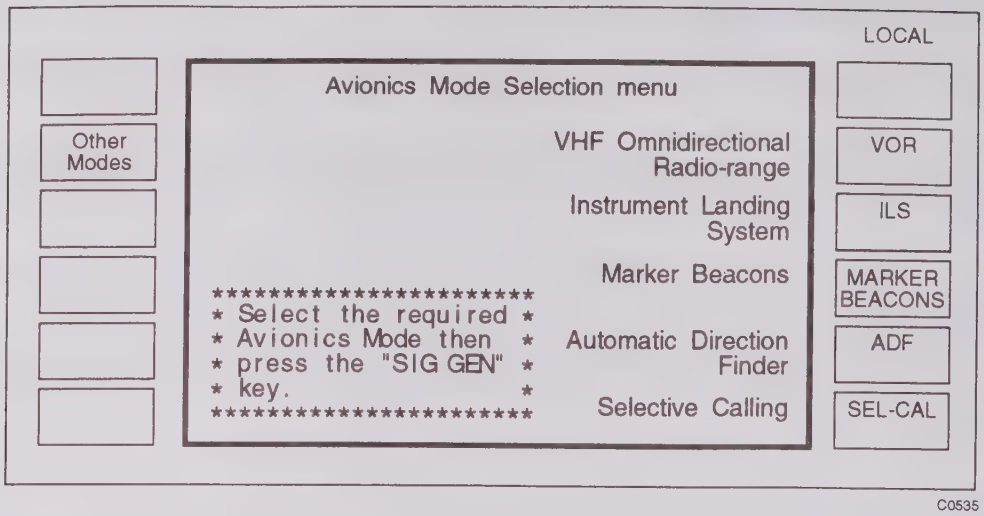

Fig. B-3 Avionics mode selection menu

ILS mode

Pressing *[ILS Mode]* and then pressing the [SIG GEN] key will result in the display shown in Fig. B-4. The default carrier frequency for ILS mode is 108.1 MHz.

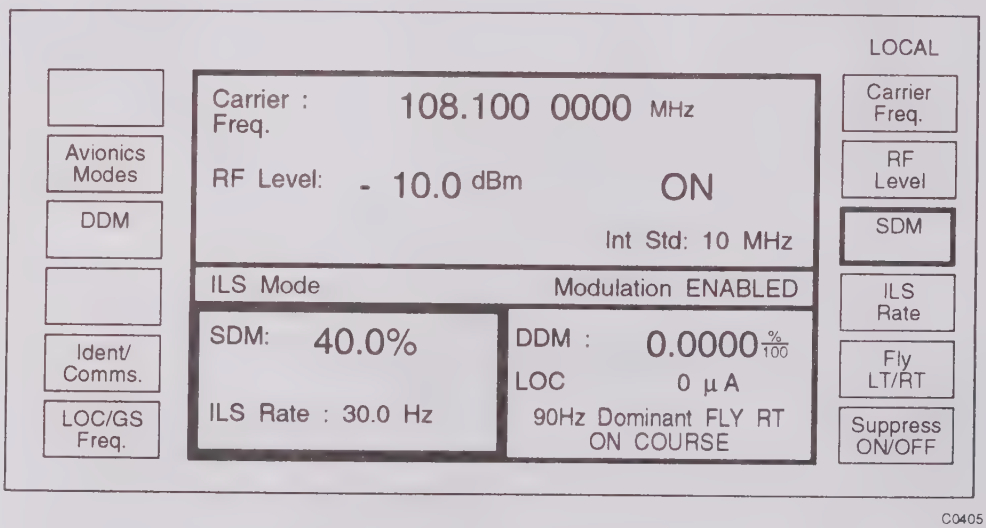

Fig. B-4 SDM selection menu

The sum of depth of modulation (SDM) is the arithmetic sum of depth of the modulating 90 Hz and 150 Hz tones. Using the *[SDM]* key the depth can be entered in %. The ILS rate is normally set to 30 Hz and is the ILS waveform repetition rate. Its frequency can be modified using the *[ILS Rate]* key. If the ILS rate is adjusted the frequency of the 90 Hz and 150 Hz alter on a pro-rata basis (e.g. If ILS Rate = 29 Hz the tone frequencies are 87 Hz and 145 Hz).

DDM control

From the SDM Selection Menu (Fig. B-4) DDM may be entered by pressing the *[DDM]* key to obtain the display shown in Fig. B-5.

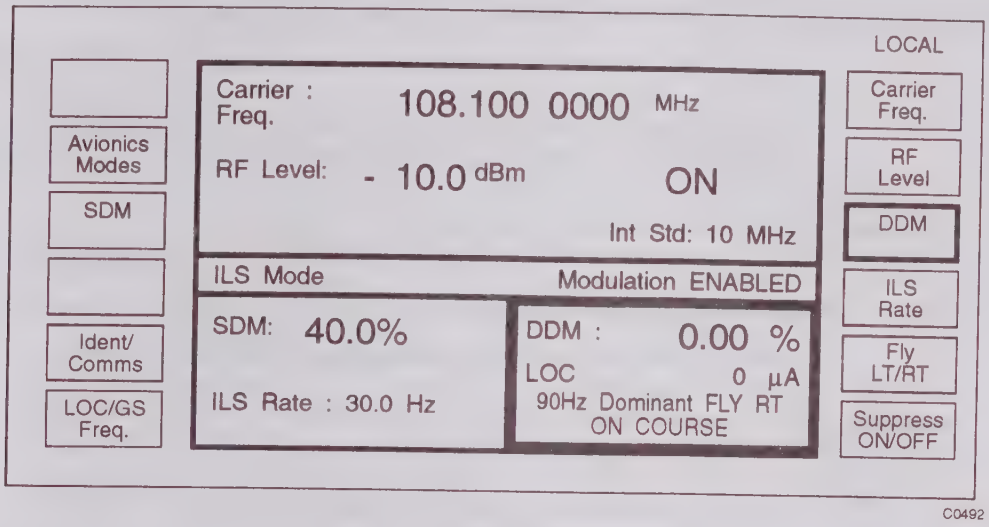

Fig. B-5 DDM selection menu

The DDM can be entered in % or as a modulation index. If the setting to be entered is an index terminate the entry with the [enter] key. The units displayed can be changed by pressing [enter] or [%] without entering any data. The *[Fly/LT/RT]* key can be used to set which tone has the greater depth of modulation and the dominant tone is displayed under the DDM set. When 90 Hz is dominant the aircraft is either to the left (localiser) or too high (glideslope). The corresponding action to be taken is displayed as FLY RT and FLY DN. Similarly when 150 Hz is dominant the aircraft is either to the right (localiser) or too low (glideslope). The corresponding action to be taken is displayed as FLT LT and FLY UP. If 0% DDM is set the additional text *ON COURSE* is displayed.

The DDM is displayed in µA as well as in %. If the carrier frequency is below 200 MHz the signal is assumed to be for a localiser and if it is above 200 MHz the signal is assumed to be for a glideslope. The appropriate conversion factors are used (150µA = 15.5% DDM on the localiser and 17.5% DDM on the glideslope) and LOC or GS is displayed.

Localiser/Glideslope frequency conversion

International agreements specify that localiser and glideslope frequencies are paired on any ILS installation. The *[LOC/GS Freq.]* provides a convenient means of switching between the localiser and glideslope frequencies. Provided the carrier frequency is set near to a recognised ILS frequency, pressing *[LOC/GS Freq.]* will result in the carrier being changed to appropriate paired frequencies.

Note...

If the carrier frequency is not set precisely to the glideslope or localiser channel frequency and the *[LOC/GS Freq.]* is operated twice, the frequency will be reset to the nominal localiser/glideslope frequency.

The default SDM is 40% for localiser and 80% for glideslope, and pressing *[LOC/GS freq.]* will automatically reset the SDM to the default value.

When changing from localiser to glideslope the *[Ident/Comms]* key will disappear and then reappear when changing back to localiser.

Tone suppression

The 90 Hz or 150 Hz tone can be suppressed when either the SDM or DDM display box is selected for data entry, using the *[Suppress ON/OFF]* key. This will result in the non-dominant tone being suppressed without altering the SDM or DDM (% or index) as shown in Fig. B-6. Selecting *[Suppress 90/150]* will change the tone to be suppressed.

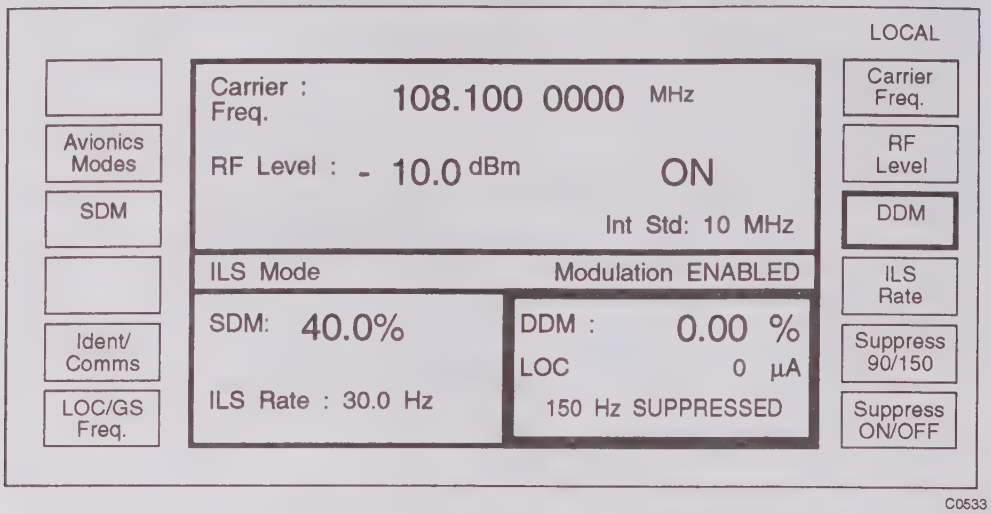

Fig. B-6 Tone suppression menu

Communication channel testing

ILS systems allow the provision of an emergency voice channel on localiser frequencies. This channel can be tested by selecting the *[Ident/Comms]* key to produce the menu shown in Fig. B-7.

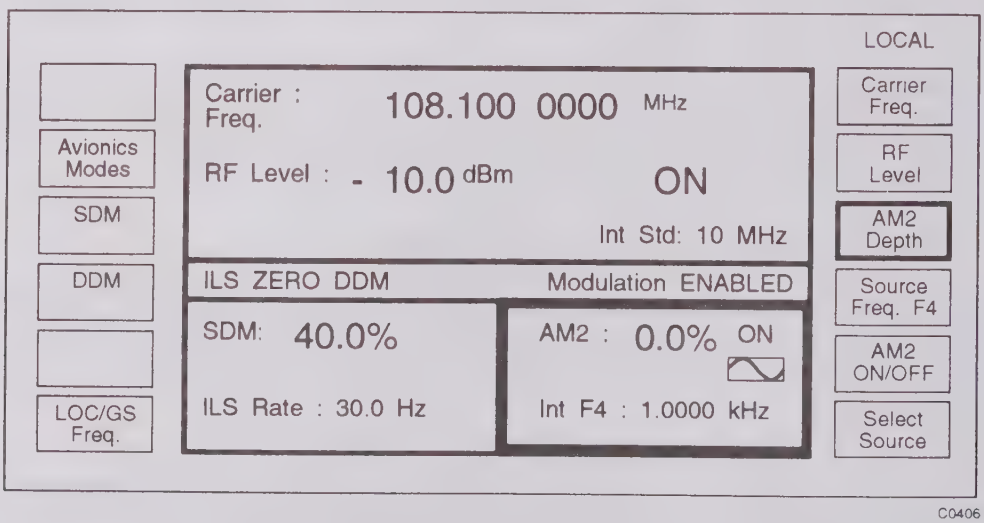

Fig. B-7 Ident/Comms selected

In this mode a fixed 0% DDM signal is provided and an additional modulation signal can be added using the *[AM2 Depth]* key. The source of this additional modulation can be set using the *[Select Source]* key. If internal modulation is selected the source frequency can be modified using the *[Source Freq.]* key. Selecting *[SDM]* or *[DDM]* will return the instrument to normal ILS mode.

Communication channel testing is normally only required on localiser frequencies and consequently changing from localiser to glideslope using the *[LOC/GS Freq.]* key will result in the *[Ident/Comms]* key disappearing. Additional modulation can be obtained on a glideslope frequency by directly entering the glideslope frequency instead using the numeric keys.

Marker beacon mode

The marker beacon mode is selected using the *[MARKER BEACONS]* key on the Avionics Mode Selection Menu shown in Fig. B-3. Selecting maker beacon mode and pressing the [SIG GEN] key produces the display shown in Fig. B-8. Initially the outer beacon is selected by default. The *[Middle Beacon]* and *[Inner Beacon]* keys change the modulation frequency to 1.3 kHz and 3 kHz respectively. Carrier frequency and AM depth can be altered, but always default to 75 MHz and 95% respectively. Modulation frequency can be changed using the *[Source Freq: F1]* key. Modulation source can be changed using the *[Select Source]* key. Pressing the *[Avionics Modes]* key returns the display to the Avionics Mode Selection Menu.

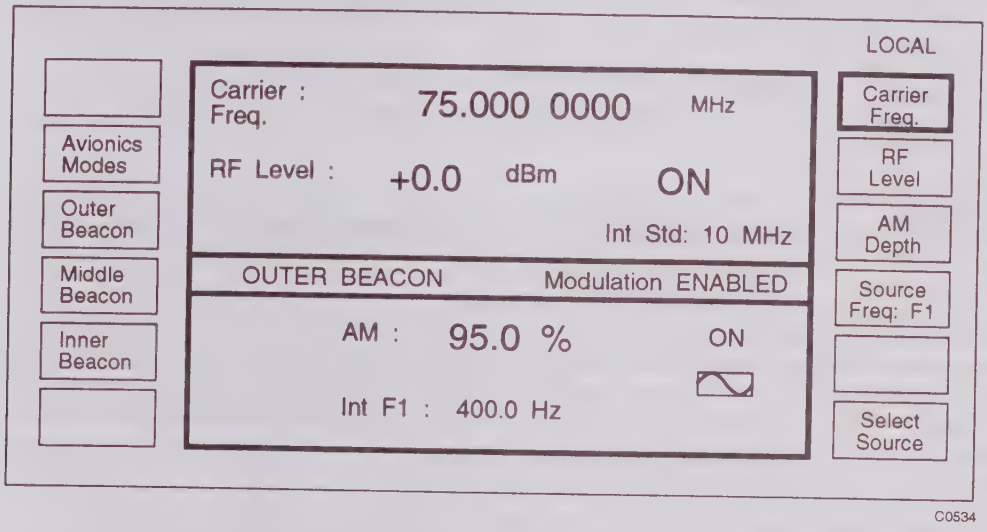

Fig. B-8 Marker beacon mode selection menu

VOR mode

VOR operation can be obtained from the Avionics Mode Selection Menu (Fig. B-3) or if other avionics modes have been selected, by first pressing the *[Avionics Modes]* key. Selecting *[VOR Mode]* will produce the display shown in Fig. B-9. The default carrier frequency for the VOR mode is 108 MHz.

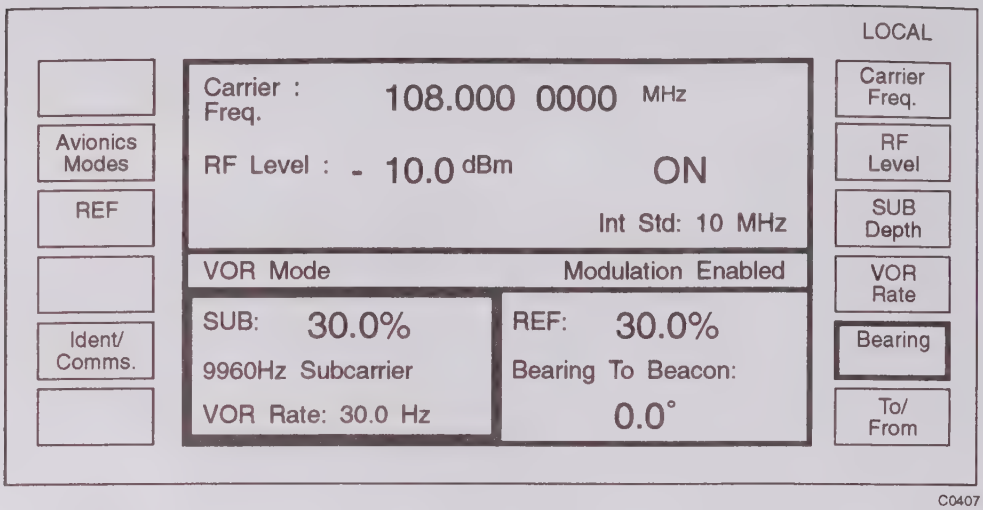

Fig. B-9 VOR mode operation

Using the *[SUB Depth]* key the AM depth of the 9960 Hz sub-carrier can be entered in % and the *[VOR Rate]* key can be used to vary the VOR repetition rate from its normal setting of 30 Hz.

To vary the 30 Hz tone AM depth or the VOR bearing select the *[REF]* key to produce the display shown in Fig. B-10. The 30 Hz tone AM depth can be entered using the *[REF Depth]* key and bearing information can be entered in degrees using the *[Bearing]* key followed by the bearing data and the [enter] key. Conventions for bearing are not internationally consistent so a *[To/From]* key is provided to allow toggling between these two conventions. Operating this key does change the bearing but not the value displayed. It also provides a convenient way of providing a 180° bearing reversal.

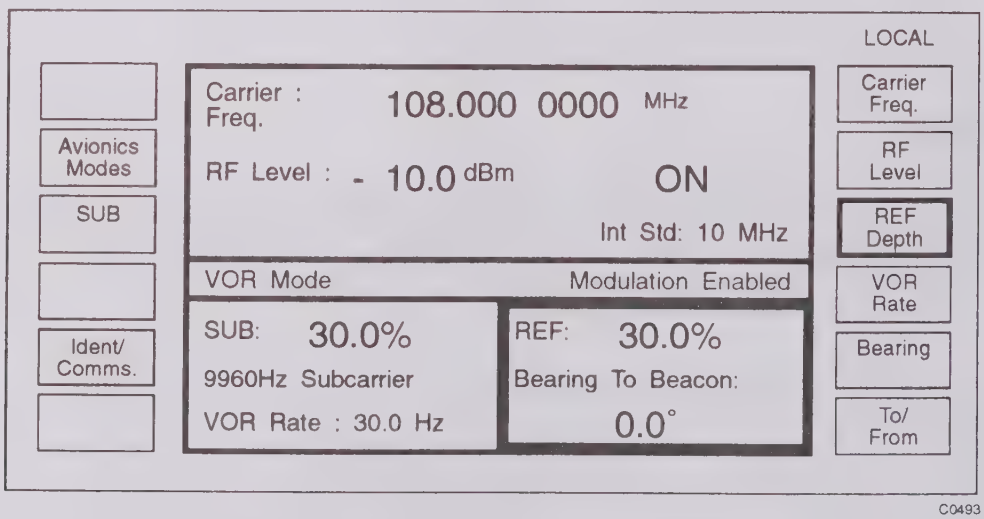

Fig. B-10 REF selected

Identity channel

VOR signals often carry a morse coded tone to identify the transmitter. This signal can be simulated by selecting the *[Ident/Comms]* key to produce the display shown in Fig. B-11.

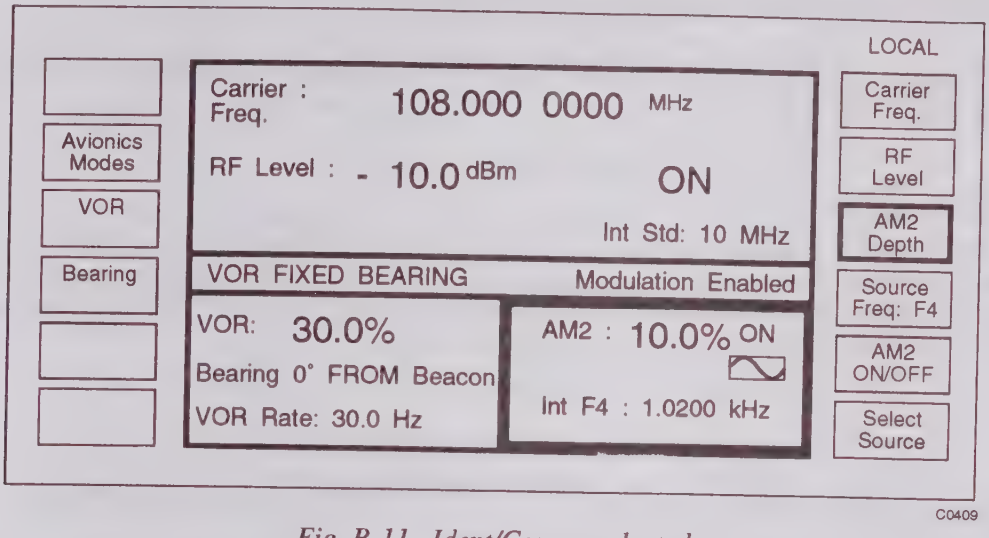

Fig. B-11 Ident/Comms selected

The instrument will generate a VOR signal having equal sub-carrier and 30 Hz tone depths with a 0° bearing. The AM depth displayed is the depth of each tone and can be changed using the *[VOR]* key.

An additional AM signal, AM2, can be added to this waveform. The source of this modulation can be selected using the *[Select Source]* key and if internal modulation has been selected the modulation frequency can be set using the *[Source Freq.]* key. The depth of this additional signal can be set by the *[AM2 Depth]* key.

ADF mode

The ADF mode is selected using the *[ADF]* key on the Avionics Mode Selection Menu shown in Fig. B-3. This menu can be selected from other aviation modes (VOR, ILS, MARKER BEACON, SEL-CAL) using the *[Avionics Modes]* key. Selecting the ADF mode and pressing the [SIG GEN] key produces the display shown in Fig. B-12.

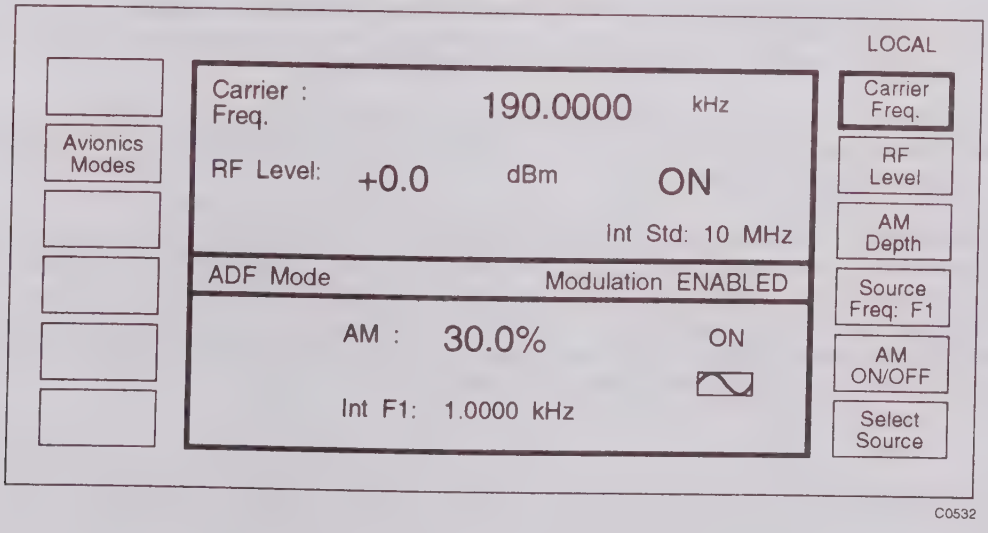

Fig. B-12 ADF mode selection menu

The carrier frequency will default to 190 kHz and the modulation depth to 30% from a 1 kHz source. This setting is used to simulate a long wave transmitter for direction finding purposes. The instrument operation is very similar to non-avionics modes with a single modulation selected (excep t that FM cannot be selected).

Pressing the *[Avionics Modes]* key returns the display to the Avionics Mode Selection Menu shown in Fig. B-3.

SEL-CAL mode

The SEL-CAL mode can be used to test receivers using AM Selective Calling Tones to the selective calling format. The mode can be selected from the Avionics Mode Selection Menu shown in in Fig B-3. Selecting SEL-CAL mode and pressing the [SIG GEN] key produces the display shown in Fig. B-13.

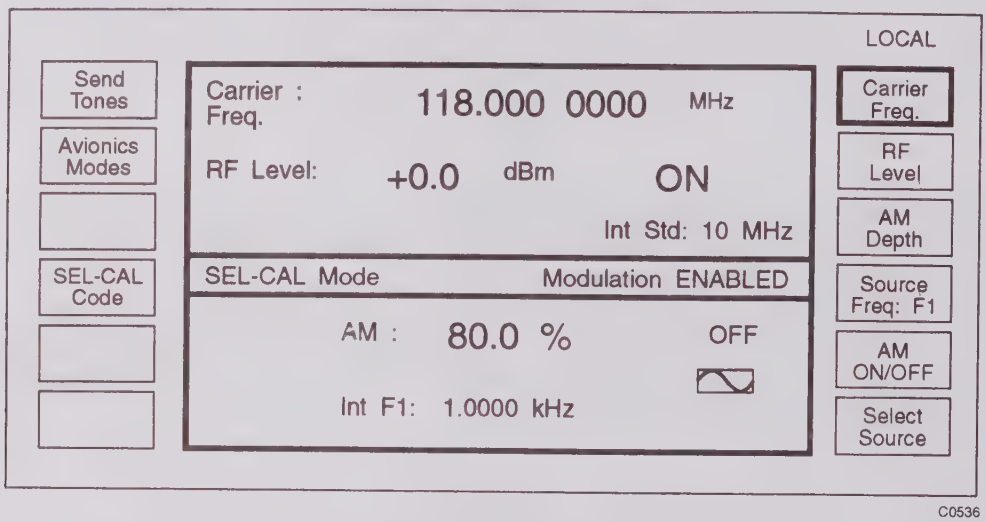

Fig. B-13 SEL-CAL mode selection menu

The instrument operation is similar to that in non-avionics modes with a single modulation selected (except that FM cannot be selected). Carrier frequency and AM depth can be altered, but always default to 118 MHz and 80% respectively.

The SEL-CAL tones can be sent by pressing the *[Send Tones]* key. While the tones are being sent *Modulation ENABLED* is replaced by the message **** SENDING TONES **** and the normal modulation tone is suppressed.

The SEL-CAL code can be modified by pressing the *[SEL-CAL Code]* key to produce a display similar to the one shown in Fig. B-14. Operation of this facility is identical to that of the Sequential Calling Tones Utility in non-avionics mode. The tone duration and gap can be set but the default values are those usually used for SEL-CAL. Alternative standards can be selected using the *[Select Standard]* key. The *[Mode Control]* key can be used to change the mode from single shot but the default setting in always single shot.

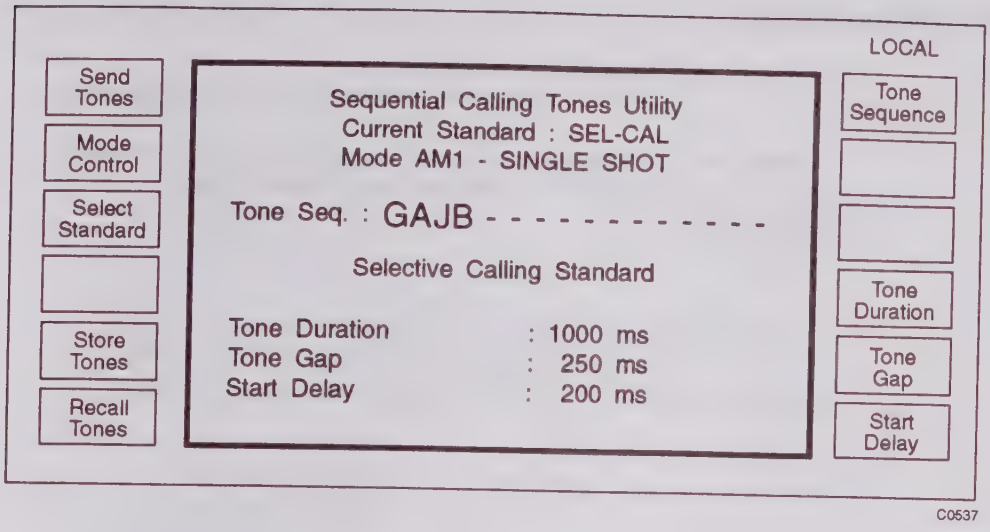

Fig. B-14 SEL-CAL tones utility

Tone sequences are entered using the *[Tone Sequence]* key to produce the display shown in Fig. B-15.

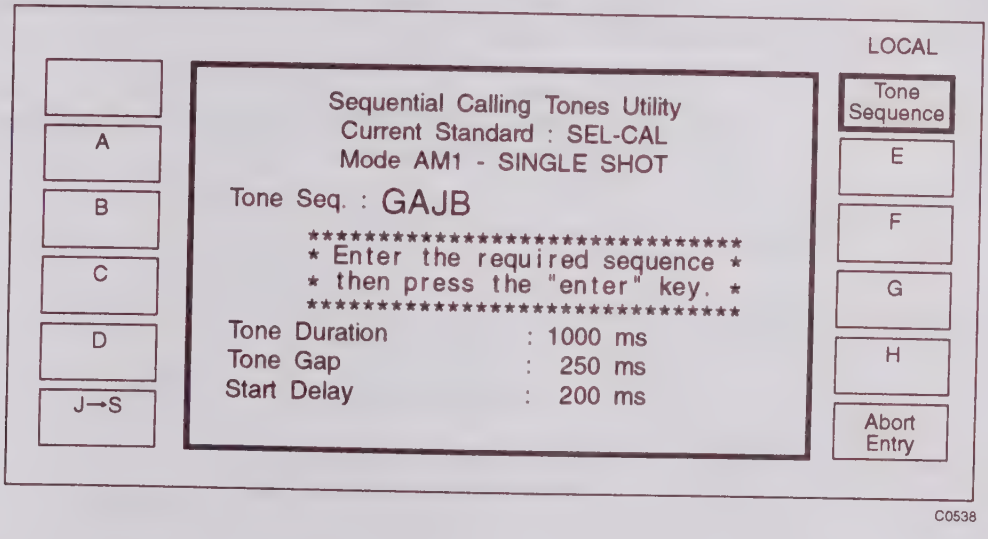

Fig. B-15 SEL-CAL tone entry

Characters A to H may be directly entered. To enter characters J to S first select the key *[J → S]*. An even number of characters is required to be entered up to a maximum of 4 (2 pairs). When the entry is complete terminate the code using the [enter] key. The display will return to that shown in Fig. B-14.

Note...

The SEL-CAL calling tones can also be selected from the Calling Tones utility used for other calling tone standards. In this mode FM is also allowed.

Rotary control

The rotary control can be used to vary major parameters in all Avionics modes by pressing the [KNOB UP-DN] key. The sensitivity of the rotary control can be changed using the [⇑] and [⇓] keys.

GPIB OPERATION

MODE

Set avionics mode
(in addition to existing modulation mode commands)

Data type : Character Program Data (valid combinations of SDM, DDM, VOR, BEAR or AM2, see Table below)
Allowed suffices : None
Default suffix : None

Examples:
```
MODE SDM,DDM (select ILS mode with DDM)
MODE SDM,AM2 (select ILS mode with AM2)
```

VALID MODE COMBINATION TABLE

ILS	VOR
SDM,DDM	VOR,BEAR
SMD,AM2	VOR,AM2

NOTE...

Order is not important, for example SDM,DDM is equivalent to DDM,SDM.

MODE?

Prepares message containing information on Modulation Mode in the following format:

:MODE<mode>
where: <mode> is character program data indicating the modulation mode settings.

Examples:
```
:MODE VOR,BEAR
:MODE SDM,DDM
```

ILS (Instrument Landing System) mode

SDM Set Sum of Depth of Modulation (short form)

:DEPTH Set SDM Depth

:INC Set SDM step size

Data type : Decimal Numeric Program Data
Allowed suffices : **PCT**
Default suffix : **PCT**

:UP Go UP one step

:DN Go DOWN one step

:RETN Return to original setting

:XFER Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

Example: `SDM:DEPTH 40PCT;INC 2;UP;UP;UP`

SDM? Prepares messages containing information on SDM in the following format:

:SDM:DEPTH <nr2>;INC <nr2>

Example: `:SDM:DEPTH 40.0;INC 0.5`

DDM90 Set Difference in Depth of Modulation with 90 Hz tone predominant (short form)

:DEPTH Set DDM90 Depth

DDM150 Set Difference in Depth of Modulation with 150 Hz tone predominant (short form)

:DEPTH Set DDM150 Depth

DDM90 or DDM150

:INC

Data type : Decimal Numeric Program Data
Allowed suffices : **PCT**
Default suffix : **None**

Note...

When there is no suffix it is assumed that the entry is in DDM index (%/100).

DDM90 or DDM150 (continued)

:UP	Go UP one step
:DN	Go DOWN one step
:RETN	Return to original setting
:XFER	Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
DDM90:DEPTH 40PCT;INC 0.1;DN;DN
DDM150:DEPTH 0.1554;INC 0.0002;UP;UP;UP
```

DDM?

Prepares messages containing information on DDM in the following format:

:<ddm>:DEPTH <nr2>;INC <nr2>

where <ddm> is a program mnemonic indicating the predominant tone (DDM90 or DDM150).

Examples:
```
:DDM90:DEPTH 0.2000;INC 0.01
:DDM150:DEPTH 0.4000;INC 0.01
```

SUPPRESS

	[not used alone]
:TONE90	Suppress the 90 Hz tone
:TONE150	Suppress the 150 Hz tone
:NONE	Remove tone suppression

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
:SUPPRESS;TONE150
:SUPPRESS:NONE
```

SUPPRESS?

Prepares messages containing information on tone suppression control in the following format:

:SUPPRESS:<status>

where: <status> is a program mnemonic indicating the tone suppresson state.

ILSF Set ILS Frequency (short form)

:VALUE	Set ILS Frequency
:INC	

Data type : Decimal Numeric Program Data
Allowed suffices : **GHz, MHz, KHz, Hz**
Default suffix : **Hz**

:UP	Go UP one step
:DN	Go DOWN one step
:RETN	Return to original setting
:XFER	Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

Example: `ILSF:VALUE 30 Hz;INC 0.1;DN;DN;DN`

ILSF? Prepares messages containing information on ILS Frequency in the following format:

:ILSF:VALUE <nr2>;INC <nr2>

Example: `:ILSF:VALUE 30.0;INC 0.5`

Marker beacon mode

There are no additional commands for marker beacon testing, the required setting is obtained by using the appropriate standard commands.

Example for setting up and sending 400 Hz outer marker beacon:

Example:
```
:CFRQ 75 MHZ;RFLV:VALUE 0 DBM;ON;:AM1:DEPTH
95 PCT;INTF1;ON;:INTF1 400 HZ;:MOD:ON;:MODE AM
```

Example for setting up and sending 1300 Hz middle marker beacon:

Example:
```
:CFRQ 75 MHZ;RFLV:VALUE 0 DBM;ON;:AM1:DEPTH
95 PCT;INTF1;ON;:INTF1 1300 HZ;:MOD:ON;:MODE AM
```

Example for setting up and sending 3000 Hz inner marker beacon:

Example:
```
:CFRQ 75 MHZ;RFLV:VALUE 0 DBM;ON;:AM1:DEPTH
95 PCT;INTF1;ON;:INTF1 3000 HZ;:MOD:ON;:MODE AM
```

VOR (VHF Omnidirectional Radio Range) mode

VOR or SUB — Set SUB Subcarrier Signal (9960 Hz) Depth (short form)

:DEPTH — Set SUB Depth

:INC — Set SUB step size

Data type : Decimal Numeric Program Data
Allowed suffices : **PCT**
Default suffix : **PCT**

:UP — Go UP one step

:DN — Go DOWN one step

:RETN — Return to original setting

:XFER — Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

Example:
```
SUB:DEPTH 30PCT;INC 2;UP;UP;UP
```

VOR? or SUB? — Prepares messages containing information on SUB in the following format:

:SUB:DEPTH <nr2>;INC <nr2>

Example:
```
:SUB:DEPTH 30.0;INC 0.5
```

REF — Set REF Variable Signal (30 Hz) Depth (short form)

:DEPTH — Set REF Depth

:INC — Set REF Step Size

Data type: Decimal Numeric Program Data
Allowed suffices : **PCT**
Default suffix : **PCT**

:UP — Go UP one step

:DN — Go DOWN one step

:RETN — Return to original setting

:XFER — Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

Example:
```
REF:DEPTH 30PCT;INC 2;DN;DN;DN
```

REF?

Prepares messages containing information on REF in the following format:

:REF:DEPTH <nr2>;INC <nr2>

Example : `:REF:DEPTH 30.0;INC 0.5`

BEARTO
:VALUE

Set VOR Bearing To Beacon (short form)
Set VOR Bearing To Beacon

BEARFR
:VALUE

Set VOR Bearing From Beacon (short form)
Set VOR Bearing From Beacon

BEARTO or BEARFR

:INC

Data type: Decimal Numeric Program Data
Allowed suffices : **DEG**
Default suffix : **DEG**

:UP Go UP one step
:DN Go DOWN one step
:RETN Return to original setting
:XFER Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

Examples:
```
BEARTO:VALUE 90DEG;INC 0.1;UP;UP;UP
BEARFR:VALUE 270DEG;INC 0.1;DN;DN;DN
```

BEAR?

Prepares messages containing information on VOR BEARING in the following format:

:<bear>:VALUE <nr2>;INC <nr2>
where <bear> is a program mnemonic indicating the Bearing convention (BEARTO or BEARFR).

Examples:
```
:BEARFR:VALUE 60.0;INC 0.5
:BEARTO:VALUE 300.0;INC 0.5
```

VORF
:VALUE
:INC

Set VOR Frequency (short form)
Set VOR Frequency

Data type: Decimal Numeric Program Data
Allowed suffices : **GHz, MHz, KHz, Hz**
Default suffix : **Hz**

VORF (continued)

:UP	Go UP one step
:DN	Go DOWN one step
:RETN	Return to original setting
:XFER	Transfer current value to be the new setting

Data type : None
Allowed suffices : None
Default suffix : None

Example: `VORF:VALUE 30Hz;INC 0.1;DN;DN;DN`

VORF? Prepares messages containing information on VOR Frequency in the following format:

:VORF:VALUE <nr2>;INC <nr2>

Example : `:VORF:VALUE 30.0;INC 0.5`

ADF (Automatic Direction Finder) mode

There are no additional commands for ADF testing, the required setting is obtained by using the appropriate standard commands.

Example:
```
:CFRQ 190 KHZ;RFLV:VALUE +10 DBM;ON;:AM1:
DEPTH 30 PCT;INTF1;ON;:INTF1 1 KHZ;:MOD:ON;:MODE AM
```

Sel-cal mode

SEL-CAL adds the following to the Sequential Calling Tones. SEL-CAL is an additional valid type. The data string representing the Tone Sequence is an even number of characters selected from the set {ABCDEFGHJKLMPQRS}.

Example for setting operating conditions:

Example:
```
:CFRQ 118 MHZ;RFLV:VALUE 0 DBM;ON;:AM1:DEPTH
80 PCT;INTF1;OFF;:INTF1 1 KHZ;:MOD:ON;:MODE AM
```

Example for setting up SEL-CAL and sending tones:

Example:
```
:SEQT:MODE:STD SELCAL;MOD AM1;:SEQT:SEQ
"GABD";SEND 1
```

ACCEPTANCE TESTING

Introduction

The test procedures in this section enable you to verify that the electrical performance of the avionics signal generator complies with the Performance Data given earlier. The test equipment recommended for this purpose is listed in Table B-1. All tests may be performed with the covers in place and are intended to be carried out in the order given. For convenience, the test equipment and specification for each test are summarized before the test procedure. These tests are in addition to those for non-avionics versions of the instrument.

These acceptance tests give a high degree of confidence that the instrument meets its specification, without the use of specialised test equipment.

The avionics option uses a method of Direct Digital Synthesis (DDS) to generate the required avionics waveforms. The accuracy of the generated waveform is therefore determined by stored digital data and the AM performance of the signal generator. These tests check the waveform generation and analogue and RF signal paths in the signal generator. Additional tests can be undertaken using specialised ILS and VOR receivers if they are available.

Test equipment

The test equipment recommended for acceptance testing is shown in Table B-1. Alternative equipment may be used provided it complies with the stated minimum specification.

TABLE B-1 RECOMMENDED TEST EQUIPMENT

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Spectrum analyzer	DC to 400 MHz Level accuracy ±1 dB	Marconi 2382
Modulation meter	500 kHz to 1 GHz AM accuracy ±1% of reading Selectable ILS filter	Marconi 2305
Oscilloscope	100 MHz bandwidth	Tektronix 2235

Functional testing of ILS waveform generation

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Spectrum analyzer	100 Hz to 400 MHz	Marconi 2382
Oscilloscope	100 MHz bandwidth	Tektronix 2235

Marconi Instruments uses a method of Direct Digital Synthesis (DDS) to generate the ILS waveforms. One DDS generated waveform contains both the 90 Hz tone and the 150 Hz tone with 0% DDM (Difference Depth of Modulation).

A second waveform is generated with 0% DDM but with the relative phase of the 150 Hz tone reversed compared to that of the 90 Hz tone.

When small levels of the second waveform are added to the first, the resultant waveform has a constant SDM and adding a proportion of the second waveform will result in the DDM of the resultant signal changing.

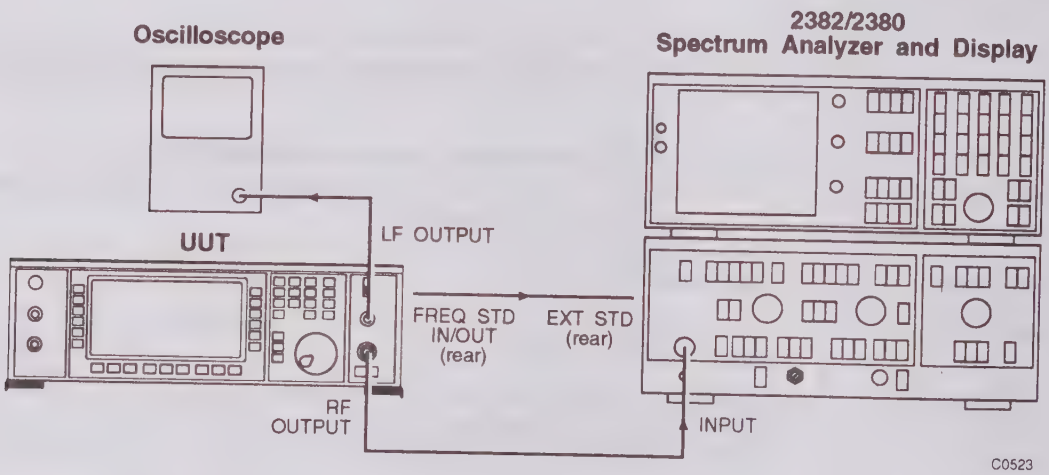

Fig. B-16 ILS functional test set-up

(1) Connect the test equipment as shown in Fig. B-16.

(2) Set up the test equipment as follows:-

Unit under test

ILS Mode

Carrier freq	108.1 MHz
RF level	7 dBm
SDM	40 %
ILS rate	30 Hz
DDM	0 %
90 Hz dominant	Fly RT

Oscilloscope

Volts/div	0.2 V
Time base	5 ms/div

Spectrum analyzer

Preset and calibrate	
Reference frequency	108.1 MHz
Reference level	10 dBm
Span/div	50 Hz
Resolution bandwidth	10 Hz

(3) The typical traces on the oscilloscope and the spectrum analyzer are shown in Figs. B-17 and B-18. These traces are for the 90 Hz and the 150 Hz tones' having equal amplitudes (i.e. 0% DDM).

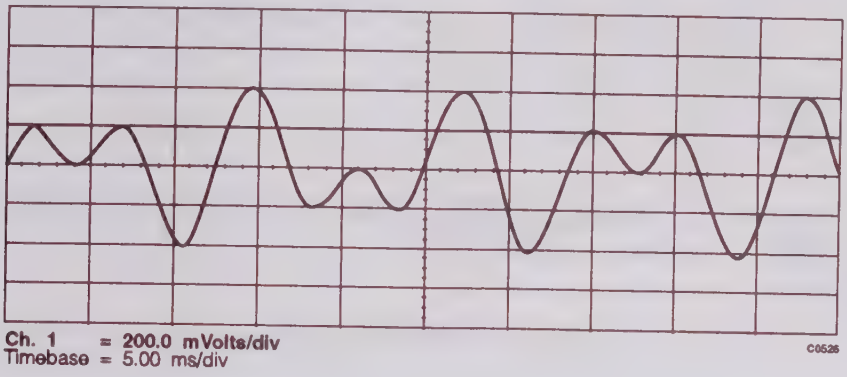

Fig. B-17 Oscilloscope trace for a 0% DDM waveform.

(4) On the UUT reduce the SDM depth using the rotary control. This will cause a reduction in the amplitude of the oscilloscope trace and the sidebands on the spectrum analyzer trace. Reset the SDM to 40%.

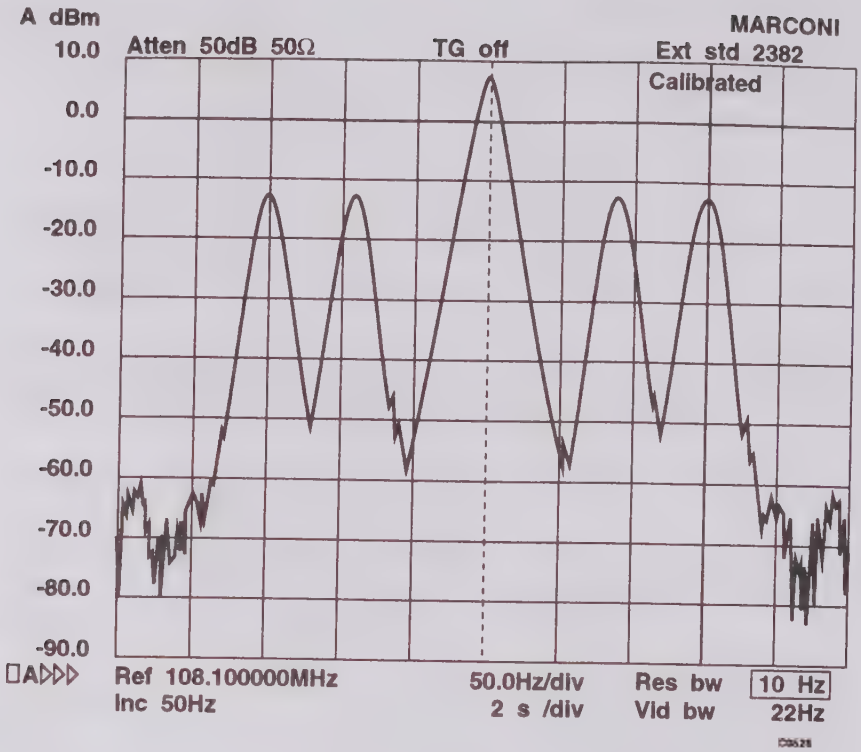

Fig. B-18 Spectrum analyzer trace for a 0% DDM waveform.

(5) On the UUT select DDM. Increase the DDM from 0% to 40% using the knob control. As the change occurs, the 90 Hz sideband should increase and the 150 Hz sideband should decrease. For a signal with a DDM of 40% the 150 Hz sideband will be suppressed as shown in Figs. B-19 (the trace is 2 ms/div) and B-20.

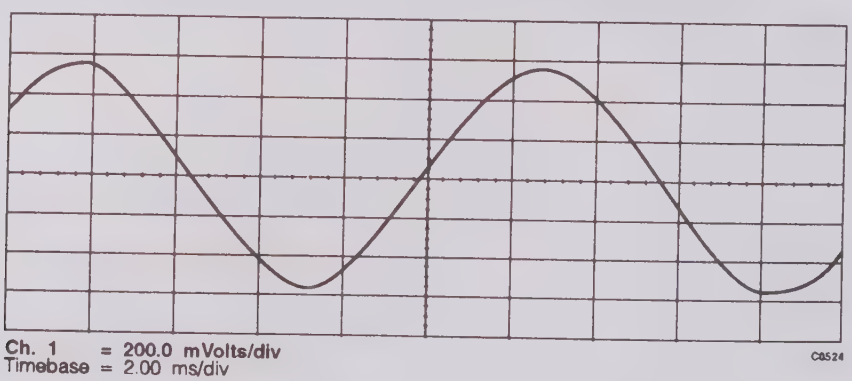

Fig. B-19 Oscilloscope trace for a 40% DDM waveform.

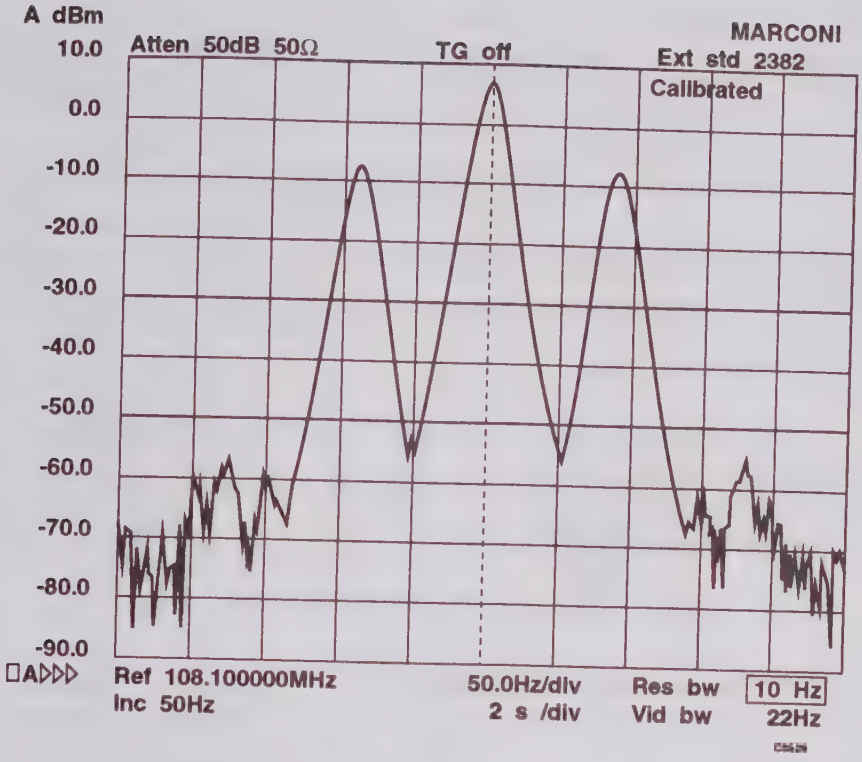

Fig. B-20 Spectrum analyzer trace for a 40% DDM waveform.

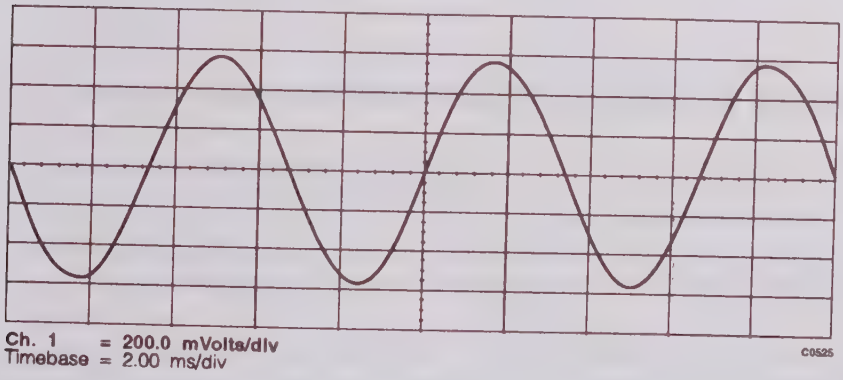

Fig. B-21 Oscilloscope trace for a 150 Hz dominant waveform.

(6) On the UUT select the 150 Hz tone to be dominant. The 90 Hz sideband should be suppressed and the 150 Hz sideband should be present as shown in Figs. B-21 (the trace is 2 ms/div) and B-22.

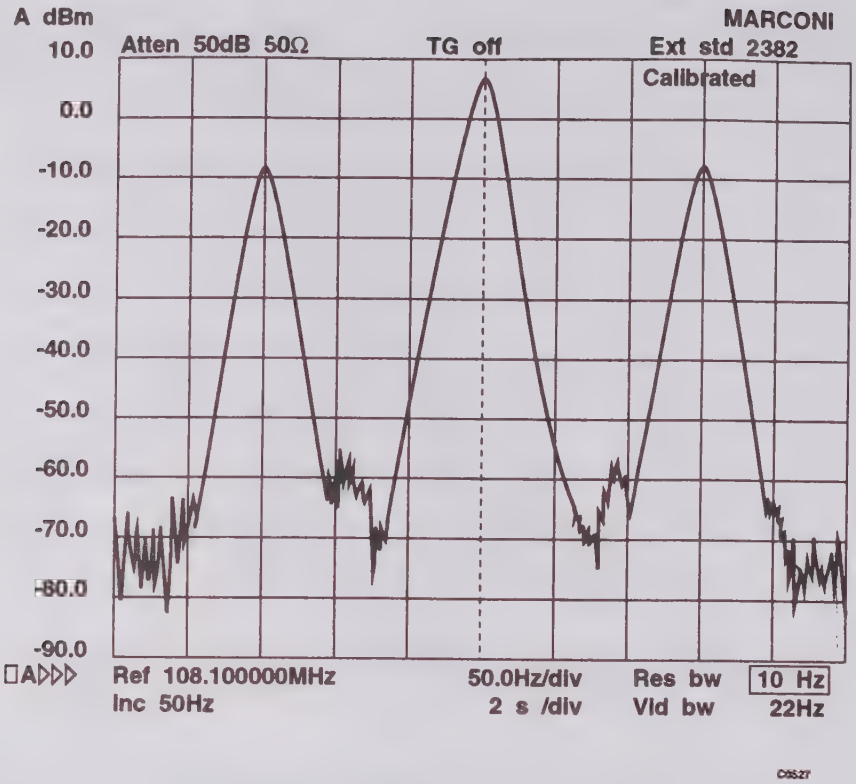

Fig. B-22 Spectrum analyzer trace for a 150 Hz dominant waveform.

Accuracy of SDM (Sum Depth of Modulation) signal path

SPECIFICATION
±2% of setting for carrier frequencies up to 400 MHz

The signal generator has a 1 dB AM bandwidth from DC to at least 30 kHz and consequently the difference in AM response between 90 Hz and 150 Hz will be small and can be neglected. Because of this, it is possible to test the SDM and the DDM accuracy of the instrument by the use of a single tone modulation at 124 Hz rate (the geometric mean of 90 Hz and 150 Hz).

The 0% DDM signal is generated using the AM 1 channel. The phase shifted signal is generated on the AM 2 channel. The design of the instrument ensures that the AM accuracy of each channel at a fixed frequency is equal to the accuracy of the ILS waveform generated by the instrument.

TEST EQUIPMENT		
Description	**Minimum specification**	**Recommended**
Modulation meter*	50 kHz to 1 GHz AM accuracy ±0.5% of reading at 40% depth ±0.7% of reading at 80% depth Selectable ILS filter	Marconi 2305

*The SDM and DDM accuracy of the Avionics Option can not be verified with a modulation meter calibrated to its published performance specification. A specially calibrated modulation meter is necessary. If more than an approximate verification is required, consult your local MI agent or the Service Division for further details.

Fig. B-23 Accuracy of SDM signal path test set-up

(1) Connect the test equipment as shown in Fig. B-23.

(2) Set up the test equipment as follows:-

Unit under test

[UTIL] *[Mod'n Mode] [Composite]*
[SIG GEN]
Carrier freq 108.1 MHz
RF level 7 dBm

[AM]
AM 1 depth 40 %
[Select Source] [Internal F1] 120 Hz sinewave
[SIG GEN]
AM 1 Off

AM 2 depth 0 %
[Select Source] [Select Internal] [Internal F2] 124 Hz sinewave
[SIG GEN]
AM 2 Off

Modulation meter

Freq tune Autotune
Function AM
Second function 28 On (see note)

Note...

In order to select second function 28 it is first necessary to unlock the 2305 to its 1st level of protection (this is detailed in the operating manual).

Second function 28 selects an ILS filter. This is a 15 kHz low-pass filter selected separately from, and without any accompanying high-pass section. This provides sufficient high frequency bandwidth for the AM ILS signal without admitting an excessive amount of noise. In the left-hand window a 1 selects the filter and a 0 deselects it.

(3) With AM channels 1 and 2 turned off, allow the modulation meter reading to settle, then measure the residual AM noise and note the reading.

Residual AM noise depth _____%

(4) On the UUT turn the AM 1 channel on. Allow the reading on the modulation meter to settle and note it. (This is equivalent to an SDM of 40 %.)

Measured AM depth _____%

Actual AM depth = Measured AM depth - Residual AM noise

Set AM	Minimum	Actual	Maximum
40%	39.2%	_____%	40.8%

(5) Repeat (4) for an AM 1 depth of 80% (this is equivalent to an SDM of 80%) with the carrier frequency set to 330 MHz.

Set AM	Minimum	Actual	Maximum
80%	78.4%	_____%	81.6%

Accuracy of DDM (Difference Depth of Modulation) waveform

SPECIFICATION
±0.03% of depth ±0.02 of setting

This specification is checked by measuring the modulation channel balance at 19.9% and 40% SDM (with and without final divide-by-5 internal attenuator).

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Spectrum analyzer or FFT analyzer	DC to 25 kHz 3 Hz filter	Marconi 2382

(1) Connect the test equipment as shown in Fig. B-24.

(2) Set up the test equipment as follows:-

Unit under test

ILS mode

Carrier freq	108.1 MHz
LF output	Monitor AM drive
SDM	40%
DDM	0%

Spectrum analyzer

Span/div	20 Hz
Frequency	0 to 200 Hz
Ref level	20 dBm
Resolution bandwidth	3 Hz
Input	DC coupled

The spectrum analyzer should display equal amplitude tones of 90 Hz and 150 Hz.

(3) Reset the test equipment as follows:

Unit under test

DDM	40%

The 150 Hz tone should now be suppressed. Check that the residual level is at least 52 dB lower than the 90 Hz tone.

(4) Reset the test equipment as follows:

Unit under test

SDM	19.9%
DDM	19.9%

The 150 Hz tone should still be suppressed. Check that the residual level is at least 52 dB lower then the 90 Hz tone.

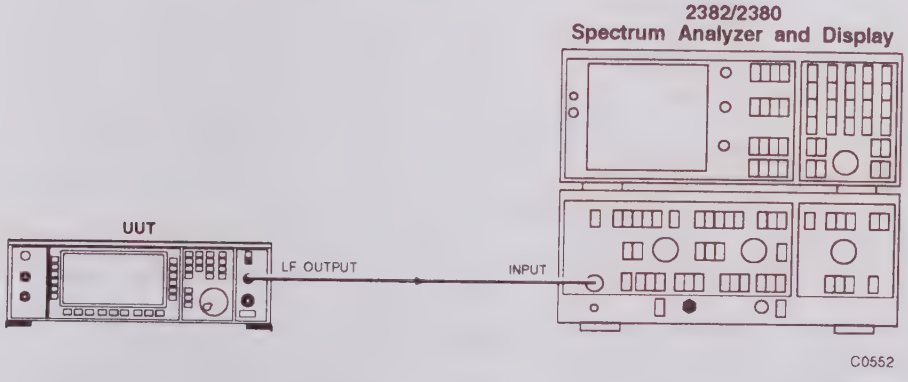

Fig. B-24 Equipment configuration for DDM waveform accuracy

VOR waveform depth accuracy

SPECIFICATION
±3% of setting ±0.5% for carrier frequencies up to 400 MHz

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	Freq range to 400 MHz AM accuracy ±1% of reading Selectable ILS filter	Marconi 2305

(1) Connect the test equipment as shown in Fig. B-23.

(2) Set up the test equipment as follows:-

Unit under test

VOR mode

Carrier freq	108 MHz
RF level	7 dBm
SUB depth	0 %
REF depth	0 %

Modulation meter

Freq tune	108 MHz
Function	AM
Second function 28	On

(3) With SUB and REF set to 0% measure the residual AM noise. Note the reading.

Residual AM noise depth _____%

(4) On the UUT select a SUB depth of 30% and a REF depth of 0%. Allow the reading on the modulation meter to settle and note it.

Measured AM depth _____%

Actual SDM = Measured AM depth - Residual AM noise

Minimum	Actual	Maximum
28.60%	_____%	31.40%

Ensure that the measured depth is in specification.

(5) Repeat (4) for a SUB depth of 0% and a REF depth of 30%.

Minimum	Actual	Maximum
28.60%	_____%	31.40%

(6) Repeat (4) for a SUB depth of 30% and a REF depth of 30%).

Minimum	Actual	Maximum
57.70	_____%	62.30%

VOR waveform test

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Spectrum analyzer or FFT analyzer	DC to 25 kHz 3 Hz filter	Marconi 2382

(1) Connect the test equipment as shown in Fig. B-24.

(2) Set up the test equipment as follows:

Unit under test

VOR mode

SUB depth	30%
REF depth	30%

Spectrum analyzer

Span/div	200 Hz
Ref freq	9.96 kHz
Ref level	10 dBm
Bandwidth	30 Hz

(3) Check that a display similar to that shown in Fig. B-25 is obtained. This shows the presence of the 9.96 kHz sub-carrier with 30 Hz rate, 480 Hz deviation frequency modulation present.

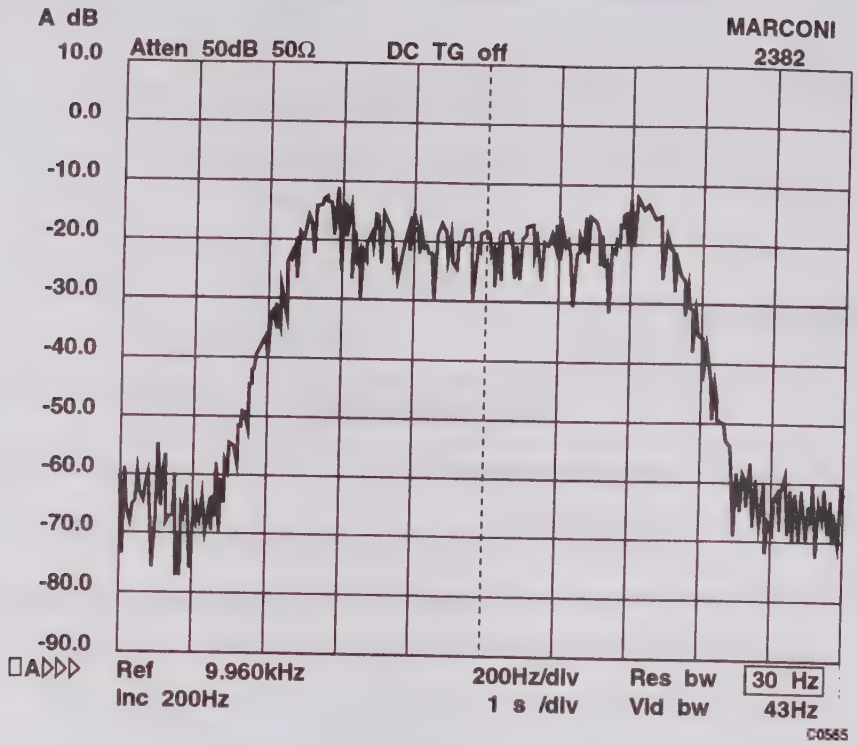

Fig. B-25 9.96 kHz sub-carrier with frequency modulation

Waveform phase control

This test is a functional test of the phase control system used on the DDS sources. The two sources are set to the same frequency and their outputs are summed together. As the relative phase of the source is changed the resulting signal amplitude will change.

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Oscilloscope	100 MHz bandwidth	Textronix 2235

(1) Connect the test equipment as shown in Fig. B-26.

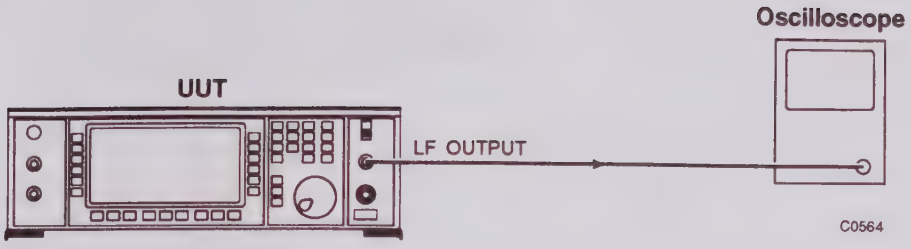

Fig. B-26 Waveform phase control test set-up

(2) Set up the test equipment as follows:

Unit under test

[UTIL] *[Mod'n Mode] [Composite]*
[SIG GEN]

LF output	Modulation monitor Modulation drive
AM1	30% ON
AM2	30 % ON
INT F1	30 Hz
INT F2	30 Hz

Set AM1 source to INT F1
Set AM2 source to INT F2

Oscilloscope

Set to monitor LF OUTPUT waveform .

(3) On the UUT select the Internal Source Selection Menu and press the *[Mod. Src Phase]* key. Enter a phase of 0° (to beacon).

Check that the LF OUTPUT is approximately 1.69 V pk-pk.

(4) Enter a phase of 180°. Check that the output tone is substantially suppressed to a level less than 80 mV pk-pk.

(5) Enter a phase of 90° and check that the output tone is approximately 1.2 V pk-pk.

(6) Enter a phase of 270° and check that the output tone has the same amplitude as in (5) above.

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2030 SERIES
AM/FM SIGNAL GENERATORS

2030 10 kHz to 1.35 GHz
2031 10 kHz to 2.7 GHz
2032 10 kHz to 5.4 GHz

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PREFACE

WARNINGS, CAUTIONS AND NOTES

These terms have specific meanings in this manual:-

WARNINGS contain information to prevent personal injury.
CAUTIONS contain information to prevent damage to the equipment.
Notes contain important general information.

HAZARD SYMBOLS

The meaning of hazard symbols appearing on the equipment is as follows:

Symbol	Nature of hazard	Reference in manual
	Dangerous voltages	Page iv
	Static sensitive components	Page iv
	Beryllium	Page v
None	Lithium batteries are used in this equipment. Appropriate caution should be exercised when handling these items.	Page vi

MANUAL AMENDMENT STATUS

Each page in this manual bears the date of its original issue or, if it has been amended, the date and status number of the amendment. Any changes subsequent to the latest amendment state of the manual are included on inserted sheets coded C1, C2 etc.

SERVICING PRECAUTIONS

ELECTRICAL SAFETY PRECAUTIONS

This product has been designed and tested in accordance with IEC Publication 348 - 'Safety Requirements for Electronic Measuring Apparatus'. To keep it in a safe condition and to avoid risk of injury, observe the following WARNING notices. To avoid damage to the equipment observe the CAUTION notices.

Defects and abnormal stresses

Whenever it is likely that protection has been impaired, for example as a result of damage caused by severe conditions of transport or storage, the equipment shall be made inoperative and be secured against any unintended operation.

Removal of covers

Removal of the covers is likely to expose live parts although reasonable precautions have been taken in the design of the equipment to shield such parts. The equipment shall be disconnected from the supply before carrying out any adjustment, replacement or maintenance and repair during which the equipment shall be opened. If any adjustment, maintenance or repair under voltage is inevitable it shall only be carried out by a skilled person who is aware of the hazard involved.

The LCD Invertor fitted to the rear of the front panel has a high voltage output. Care should be taken when handling the Invertor which provides approx. 1 kV to drive the LCD backlight.

Note that capacitors inside the equipment may still be charged when the equipment has been disconnected from the supply. Before carrying out any work inside the equipment, capacitors connected to high voltage points should be allowed to discharge through the bleed resistors fitted for the purpose; do not attempt to remove the safety covers from the power supply until the lamp under the top cover stops blinking. Should the unit be reconnected to the supply with the safety covers removed then disconnected, do not attempt to discharge the power supply unit's main reservoir capacitors using a shorting link as the equipment may be damaged. Discharge should always be allowed to occur gradually.

AC supply plug

The supply plug shall only be inserted in a socket outlet provided with a protective earth contact. The protective action shall not be negated by the use of an extension lead without protective conductor. Any interruption of the protective conductor inside or outside the equipment is likely to make the equipment dangerous.

Fuses - primary

Note that there is a supply fuse in both the line and neutral wires of the supply lead. If only one of these fuses should rupture, certain parts of the equipment could remain at supply potential.

To provide protection against breakdown of the supply lead, its connectors, and filter where fitted, an external supply fuse (e.g. fitted in the connecting plug) should be used in the line lead, The fuse should have a continuous rating not exceeding 6 A.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short-circuiting of fuse holders shall be avoided. For details of primary fuses, refer to Chap. 2 in the Operating Manual.

CAUTION - STATIC SENSITIVE COMPONENTS

Components identified with the symbol ⚠ on the circuit diagrams and/or parts lists are static sensitive devices, The presence of such devices is also indicated in the equipment by flags or labels bearing the symbol. Certain handling precautions must be observed to prevent these components being permanently damaged by static charges or fast surges.

(1) If a printed board containing static sensitive components (as indicated by a warning disc or flag) is removed, it must be temporarily stored in a conductive plastic bag.

(2) If a static sensitive component is to be removed or replaced the following anti-static equipment must be used.

A work bench with an earthed conductive surface.

Metallic tools earthed either permanently or by repeated discharges.

A low-voltage earthed soldering iron.

An earthed wrist strap and a conductive earthed seat cover for the operator, whose outer clothing must not be of man-made fibre.

(3) If using a freezer aerosol in fault finding, take care not to spray programmable ICs as this may affect their contents.

CAUTION - LCD HANDLING

Take care not to depress the front or rear faces of the display module as this may damage the liquid crystal display elements. To clean the display, use a soft cloth moistened with ethyl alcohol or isopropyl alcohol. Do not use acetone, turpentine, thinners, paraffin or any abrasive material as these could damage the bonded polarizer.

CAUTION - IC REMOVAL

Damage can be caused if an IC mounted in a PLCC (Plastic Leaded Chip Carrier) is removed without the use of a special tool, Part Number WP02, available from Marconi Instruments Service Division (address on rear cover).

WARNING - TOXIC HAZARD

Many of the electronic components used in this instrument employ resins and other chemicals which give off toxic fumes on incineration. Appropriate precautions should therefore be taken in the disposal of these items.

WARNING - TOXIC HAZARD

Beryllia (beryllium oxide) is used in the construction of the following components in this equipment:

Board AB3/5 (2031): TR2 & TR3
Board AB3/4 (2032): TR111, TR206 to TR209, TR402, D405 & D406
Board AB2/2 (2030,2031,2032): TR315
Board AB3/3 (2030 fitted with Option 003): TR5 & TR7

This material, when in the form of fine dust or vapour and inhaled into the lungs, can cause a respiratory disease. In its solid form, as used here, it can be handled quite safely although it is prudent to avoid handling conditions which promote dust formation by surface abrasion.

Because of this hazard you are advised to be very careful in removing and disposing of this component, Do not put it in the general industrial or domestic waste or dispatch it by post. It must be separately and securely packed and clearly identified to show the nature of the hazard and then disposed of in a safe manner by an authorised toxic waste contractor.

WARNING - TOXIC HAZARD

A lithium battery is used in this equipment. This presents two hazards:-

(1) As lithium is a toxic substance the battery should in no circumstances be crushed, incinerated or disposed of in normal waste.

(2) If the battery is rapidly charged or discharged there is a risk of explosion. Take care therefore to avoid short-circuiting it.

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TECHNICAL DESCRIPTION

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INTRODUCTION

The 2030 series signal generators cover the frequency range 10 kHz to 5.4 GHz with three models: 2030 (10 kHz to 1.35 GHz), 2031 (10 kHz to 2.7 GHz) and 2032 (10 kHz to 5.4 GHz). Output levels from -144 or -138 dBm to 13 dBm are available (extended to +19 dBm on the 2030 model fitted with Option 003). Fig. 4-2-1 is a block diagram of the frequency synthesis and signal processing circuits.

Synthesizer

The VCXO operating at 104.8576 MHz is phase locked to the internal (or external) frequency standard using a phase comparator at 1 MHz on AA1/2. The VCXO signal is divided by 62.5 to give a 1.6777216 MHz (0.1 Hz x 2^{24}) reference frequency for the output loop phase comparator.

A Fractional N loop is used to lock a VCO, one of four oscillators covering a range of 675 MHz-1350 MHz, to the reference with a resolution of less than 0.1 Hz. A high speed programmable divider is used to divide the VCO frequency down to 1.6777216 MHz and a phase comparator compares this signal with the reference derived from the VCXO. The output from the phase comparator corrects the VCO frequency. In order to provide the required division ratio, the programmable divider is required to act as Fractional Divider. The Fractional N gate array controls the division ratio of the programmable divider. The variation of this division ratio by the controller enables the loop to lock, with non-integer division ratios, to the reference with the resolution of less than 0.1 Hz without introducing spurious signals.

FM is produced using a two point modulation scheme. The FM signal is inserted into the loop by summing the FM signal with the VCO tune line (on AB2/2) to modulate the VCOs directly. Simultaneously, the FM signal is fed to the Fractional N Controller via a 1-bit oversampled A-D converter which converts an analogue input into a bit stream of '1's and '0's. The controller uses this input to modulate the division ratio in sympathy with the modulation. This allows frequencies less than the loop bandwidth, including DC, to modulate the output frequency.

In order to maintain good FM performance of the two point modulation system, the VCO FM tracking characteristics are required to be known. The sensitivity of the FM system via the 1-bit oversampled A-D converter is VCO independent and accurately calibrated by a DC calibration system. The VCO tracking is derived by an automatic FM SELFCAL routine during calibration. During an FM SELFCAL, the error signal on the tune line, for a frequency near the loop bandwidth, is monitored while varying the FM calibration numbers, allowing the variation in VCO sensitivities to be calibrated out. This will remove any perturbation of FM flatness near the loop bandwidth due to mismatch of two modulation paths.

The Fractional N output loop has three available bandwidths which are used according to the instrument state:

3 kHz for CW mode 300 Hz for FM mode	Controlled on AA1/2 by changing phase comparator gain and the loop filter values on AB2/2.
10 kHz for sweep mode	Controlled by changing loop filter values on AB2/2.

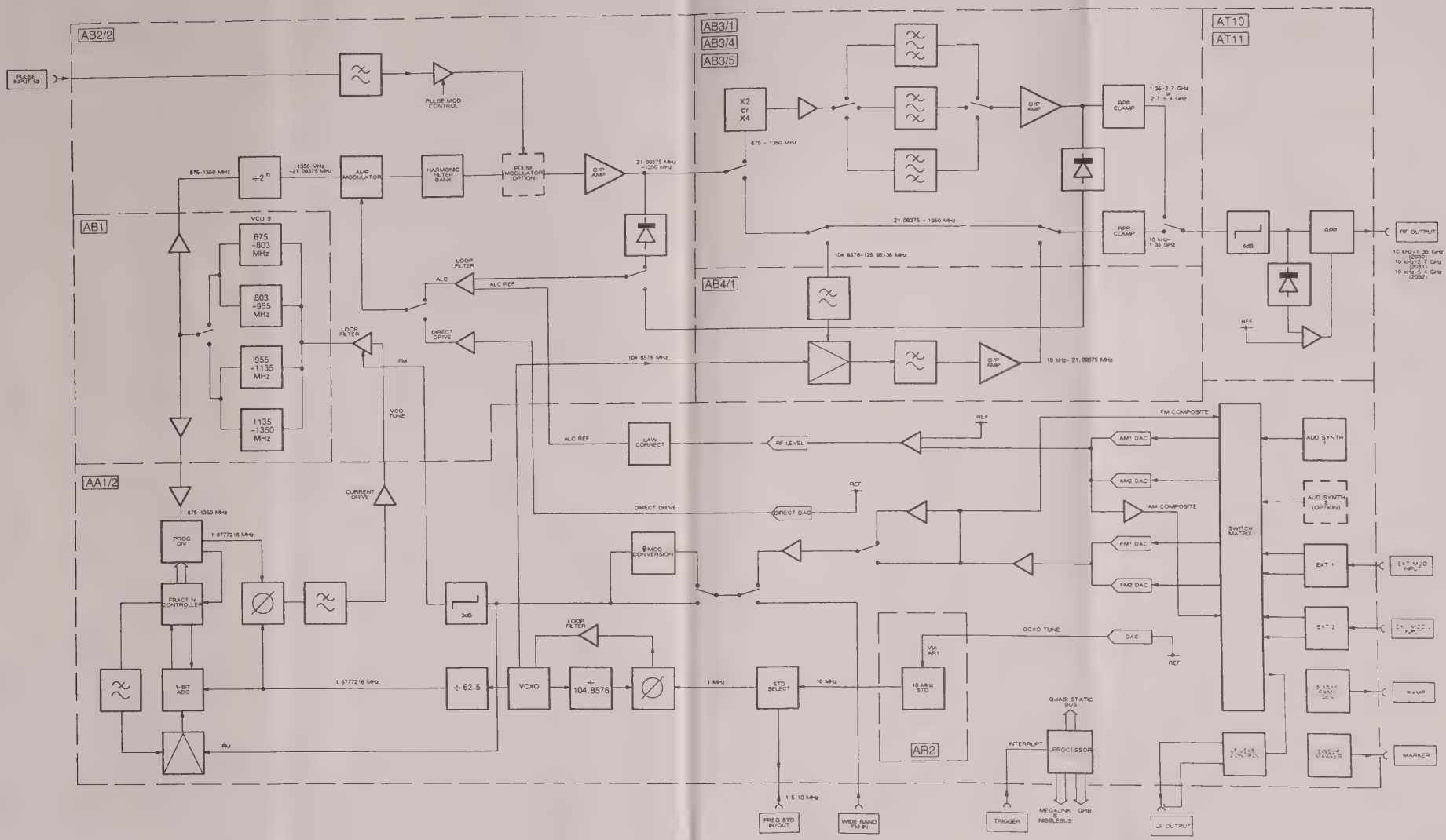

Fig. 4-2-1 Signal generator block schematic

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RF processing

The four quarter octave VCOs on AB1 provide a frequency in the range 675 MHz to 1350 MHz. This is passed onto AB2/2 where the signal is divided by factors of 2 to give frequencies in the range 21.09375 MHz to 1350 MHz.

This signal passes through the amplitude modulator where the output level envelope is controlled. After passing through a bank of switched half octave harmonic filters and, optionally, the pulse modulator, the signal passes to the output amplifier. This provides, at the output of AB2/2, signals in the range 21.09375 MHz to 1350 MHz at a level sufficient to give an output of between 0 dBm and 13 dBm at the front panel. The signal level at the output of AB2/2 is peak to peak detected.

The ALC system on AB2/2 compares the detected signal with the ALC reference voltage and controls the amplitude modulator. The ALC reference is varied to compensate for insertion losses between AB2/2 and the front panel (including variation in attenuator pad values). The ALC reference voltage also has the AM envelope superimposed on it and the modulation waveform is corrected for the diode law of the detectors.

When pulse modulation is selected, the amplitude modulator is controlled by the Direct Drive. This DC voltage from a D-A converter on AA1/2 is set whenever the pulse modulation is selected or any RF parameter is varied while in pulse mode. The Direct Drive voltage is set to be the same as the voltage drive to the modulator when the ALC is operating. The pulse modulation signal is fed through a filter (to prevent RF radiation at the PULSE INPUT socket) and amplitude limited on AB2/2 before being used to drive the pulse modulator module.

The signal from AB2/2 passes onto an AB3 board (in 2030, AB3/1; in 2031, AB3/5 and in 2032, AB3/4). If the requested output frequency is in the range 21.09375 MHz to 1350 MHz the relays route the signal out of the RF box to the step attenuator.

Beat frequency oscillator (BFO)

For frequencies less than 21.09375 MHz, an AB3 board routes the signal from AB2/2 to AB4/1 where it is mixed with a 104.8576 MHz local oscillator, (driven from the VCXO on AA1/2), filtered, amplified and routed out to the attenuator via an AB3 board. The BFO system output level is controlled by using the normal ALC system to control the level of the 104.8676 MHz to 125.95135 MHz signal from AB2/2. The gain of the BFO system is well controlled by using negative feedback around the BFO amplifier. The remaining small errors in BFO gain are calibrated out during routine calibration.

Frequency doubler AB3/5

In the 2031, when frequencies greater than 1350 MHz are requested, the AB2/2 board generates a signal in its top octave and the AB3/5 board routes the signal through a doubler, third octave filters and an amplifier. This output is peak detected and routed to the attenuator. The detected voltage is now used instead of the detected voltage on AB2/2 as the feedback in the ALC control loop.

Frequency quadrupler AB3/4

In the 2032, board AB3/4 operates similarly to AB3/5 in the 2031, except that it has two doublers, the second of which produces quadrupled frequencies in the range 2.7 to 5.4 GHz.

Attenuator

Attenuator AT10 provides attenuation in 6 dB steps controlled by relays. Correction numbers for the individual pads are stored along with the attenuator serial number and other details on an EEROM (Electrically Erasable Read Only Memory) situated on the attenuator control board AT11. This complete module communicates with the main processor via the nibble bus. The attenuator also includes an RPP (Reverse Power Protection) system to protect the instrument from accidental application of reverse power.

LF processing

The LF processing all takes place on the control board, AA1/2, and may be conveniently subdivided into the following major functional elements.

LF synthesizer(s)

The internal LF synthesizer and the optional second internal LF synthesizer are both direct digital synthesizers using PROM look up tables and are driven by a 1.6777216 MHz clock from the reference divider of the RF synthesizer. The PROM contains both sine and triangular waveforms.

LF switch matrix

Each external modulation input may be AC or DC coupled and has its own associated ALC using JFETs to level the applied signal to give calibrated modulation. The switch matrix allows any of the four modulation channels to use any of the sources available. It also allows the LF output to be used as a LF generator with variable output level, using an internal LF synthesizer or to monitor points through the modulation paths with fixed output level.

AM and level control

The amplitude modulation signal is formed by summing the two AM channels, the AM depth being determined by the amplitude of these signals, and a DC reference. This signal passes through a 12-bit D-A converter, which controls the RF output level, and a law correction circuit to produce the ALC reference for the AB2/2 board.

FM

The FM drive is the sum of the two FM channels whose amplitude controls the FM deviation over a 3 dB range. For phase modulation this signal passes through a passive high-pass network to give the equivalent FM drive signal.

This signal is used as the input to the 1-bit oversampled A-D converter to inject the FM into the digital path and as the drive for the VCOs directly via the 50 Ω step attenuator. The step attenuator allows the FM deviation to be varied over the range of the instrument with attenuation

available up to 93 dB in 3.02 dB steps. The Fractional N controller scales the A-D converter input internally by digital means.

Wideband FM

The Wide Band FM input allows an external signal to be injected at the input to the FM step attenuator to enable the signal to be used on both modulation paths. This gives high bandwidth by virtue of the passive step attenuator and DC coupling via the 1-bit oversampled A-D converter. The sensitivity of this FM port can only be controlled in 3.02 dB steps and is frequency dependent.

CONTROL BOARD - AA1/2

Circuit diagrams: Figs. 7-2 to 7-9.

This board contains the main processor and memory, as well as the carrier and audio frequency synthesizers. It also controls the audio, frequency and phase modulation operations.

CONTROL: PROCESSOR AND INTERFACE (AA1/2 sheet 1)

Circuit diagram: Fig. 7-2.

Microprocessor

Microprocessor IC101 is an Intel 80188 and is the main processor (there is another in the Display Unit). It contains the CPU (Central Processor Unit) and several peripheral devices including an interrupt controller, DMA (Direct Memory Access) controller, timers and programmable chip select outputs. The microprocessor uses an 8-bit data and a 20-bit address bus to address 1 Mbyte of memory. The data bus is multiplexed to provide either 8 bits of data or the lower 8 bits of the address.

Control signals TI0 and TI1 for the internal programmable timer and ARDY and SRDY for asynchronous/synchronous data transfer are tied high, the functions unused. TEST is held low, also unused. NMI, HOLD and DRQ1 are disabled by being held low. The clock input on X1 is from 16 MHz crystal XL101, the frequency of which is divided by 2 internally to generate the 8 MHz clock signal. At the RES input (protected by D101) a reset is generated by R103 and C130 whenever the power is switched on. This signal is inverted and, at the RESET output, is used as the system reset. WR (write) and RD (read) asserted low enable the memory or I/O device selected by the address bus to be written into or read out from respectively. DT/R (Data Transmit/Receive) is used to control the direction of data flow through the data bus buffer; this line is taken low for a data read operation and high for a write operation. Also associated with this signal is DEN, the data enable for buffer IC118. This signal is active low but is taken high to disable the buffer whenever DT/R changes state. PCS0 to PCS5 provide active-low Peripheral Chip Select signals. Similarly LCS, MCS and UCS provide Lower, Middle and Upper Chip Select signals for the memory bank. Output TO0 provides a timing signal for ULAs IC201 and IC209 (sheet 2).

The processor uses a multiplexed data bus to accommodate the 20-bit address. Output lines A8 to A19 carry the high order memory address. Input/output lines AD0 to AD7 carry the low order memory address during the first clock cycle and then carry data during the second and third machine state clock cycles. ALE (Address Latch Enable) is used to differentiate between data and address; when it is taken high the contents of the data bus are treated as part of the address and latched into IC103. ALE also latches A16-A19 into IC102 in order to complete the 20-bit address. When ALE is taken low lines AD0 to AD7 carry data. Only 17 address bits are in fact used as 128 kbyte is the largest number of bytes addressed in any single device.

Interrupts

The 80188 has four interrupt request inputs, INT0 to INT3. Interrupt INT0, the highest priority interrupt, is supplied by GPIB INT from GPIB controller IC113. INT1 operates in conjunction with DRQ0 (DMA channel 0) to perform data transfers between this board and front panel control board AF2/1. INT2 is from status interrupt detector IC108. The interrupt is applied via a deglitcher formed by IC121b and R109 and C134. It ensures that only if the interrupt has been asserted for long enough for the capacitor to charge through the resistor, and thus produce a high output from the AND-gate, will the interrupt be accepted as valid. INT3 from EXT TRIG INT is requested when an external trigger signal is applied to the SWEEP TRIG socket on the rear panel. R107 and C131 filter out glitches. R108 permits operation by the closing of a simple external switch. IC121c converts to TTL while IC122f inverts the signal to form the high EXT TRIG INT signal.

Memory bank

The operating program is contained in up to three EPROMs (ultra-violet Erasable Programmable Read Only Memories) IC109, IC111 and IC112 which together provide 384 kbytes of memory. IC20 is a 32 kbyte RAM (Random Access Memory) used for scratch-pad read write operations. Unlike the other memory ICs which are non-volatile, the contents of the RAM are lost when the instrument is switched off. EAROM (Electrically Alterable ROM) IC114 provides 8 kbytes of non-volatile storage for calibration data, user stores, etc. These five ICs are connected to programmable chip select lines LCS, MCS and UCS from the processor. By this means, the exact locations in the address space are determined by the initialisation software which is executed at switch-on. When the onset of a power failure (a brown-out) is detected by AR1 it pulls PLAA to +26 V which, via IC127, prevents any further write operations until after the EAROM is disabled.

Communication interface

The main microprocessor communicates with the front panel microprocessor on AF2/1 via a serial link. Data input consists of information relating to key presses, knob rotation, faults etc. Data output is mostly display information.

Data in

Data input is accomplished on this board using SIPO (serial-in, parallel-out converter) IC126, decoder IC123 and an R-S bistable used for interrupt request formed by NAND-gates IC124c and d. The SIPO is an 8-bit serial-in, parallel-out shift register with internal latches and tri-state outputs.

The data transfer process starts with the front panel processor taking TX/RX high to enable the AF2/1 send buffers. It then uses SCL to serially clock 8 bits of data into the shift register of the SIPO.

When the complete data byte has been transmitted, the front panel processor pulses BTF low. BTF is inverted by IC122d then ANDed with TX/RX by IC121d. This provides an enable signal for the SIPO's internal latches which then accept the data. BTF pulsed low with TX/RX low sets the R-S bistable and a main processor interrupt is requested on INT1.

When it services the INT1 interrupt, the main processor reads the data latched in the SIPO. The I/O address formed by A5, A6 and PCS5 causes pin 5 of decoder IC123 to pulse pin 5 low, this is gated with RD by OR-gate IC127b to provide output enable EN3 for the SIPO. This action has two further effects: the decoder output resets the bistable, removing the interrupt; and the output enable provides RACK (Receipt ACKnowledge) for the front panel processor. RACK tells the front panel that it is free to send another byte by repeating the data input process.

Data out

Data output is accomplished on this board using PISO (parallel-in, serial-out converter) IC125, decoder IC123 and an R-S bistable used for DMA request formed by NAND gates IC124a and b.

The process starts with the main processor writing the first byte of the message into PISO IC125. The I/O address formed by A5, A6 and PCS5 causes pin 4 of the decoder to pulse low. This is gated with WR by OR-gate IC27a to latch the data into the PISO by taking its pin 1 low. At the same time, the DMA request bistable is cleared and RRQST (Receipt ReQueST) informs the front panel processor that data is available to be read.

The front panel processor responds by sending TX/RX low, enabling the PISO clock on pin 15. The parallel data is then serially shifted out onto the TX data line by the serial clock SCL to pin 2, and sent to board AF2/1.

When the byte has been received, the front panel processor pulses BTF low which enables the decoder. With TX/RX also low, pin 12 is taken low which sets the bistable output high to request DMA on the main processor DRQ0 input.

The DMA channel uses its source pointer to address the memory to obtain the next byte of data, and its destination pointer to select the PISO for storing the obtained byte. Data transfer continues using the DMA process until the required number of bytes has been sent.

Status interrupts

IC108 is a magnitude comparator that detects any change in the status of certain control lines. These lines, there are 8 of them, monitor fault conditions such as ALC high or low, VCO out of lock etc. The states of these lines are held latched in IC107 and applied to one half of the comparator. The same lines in a 'live' condition, i.e. able to indicate a change of state, are applied to the other half of the comparator. The comparator compares the two sets of lines for equality; when they are the same output pin 19 is low. But if a change of state is detected, e.g. a VCO goes out of lock, comparator pin 19 is taken high to cause a status interrupt at the processor INT2 input. Interrupts thus occur not only when an error is caused but also when an error is rectified.

To service the interrupt the processor addresses buffer IC110 with PCS1 then pulses RD low. This enables the buffer's tristate outputs and the processor reads the status byte. The processor writes this data into D-type bistable IC107. With both sets of inputs again the same, comparator output returns low and the interrupt request is removed ready for the next change in the status line.

Nibble bus

The nibble bus circuit performs two functions. For the first function tristate buffer IC104a is disabled by IC105 pin 9 being taken high. This allows comparator IC106, D-type bistable IC105 and buffer IC104b together to perform a similar function to the status interrupts circuit. In this case however, the lower 4-bits of data on AD0 to AD3 are compared for equality and IC106 output pin 6 is taken high if true. This output is fed to pin 18 of the status comparator. IC108 thus uses one input to check the states of four lines. When an interrupt is serviced, and the processor finds bit 7 of the status byte changed, it uses PCS2 and RD to read the nibble then pulses WR to relatch IC105.

For the second function, the circuit performs as an interface to devices outside the RF box assembly; these being an attenuator assembly and an optional second RF box assembly. The interface functions using 4 quasi-bidirectional data/address lines, AD0 to AD3 and the STROBE line. But first, to disable the status interrupts function, IC106 pin 3 is taken low.

To send data the 4-bit address is placed on the nibble bus and STROBE taken high, latching this address at the destination. The data is then put on the bus and the STROBE taken low latching the data at the address previously selected.

The nibble bus can also be used to receive data. A nibble of data at the remote node is connected to the bus via resistors of suitable value (a few kilohms). While the main processor is sending, the low output impedance of the driver controls the bus, but if the tristate sender is sent open circuit the remote data is seen on the bus via the resistors which are now of small impedance compared to the input. If needed, one of a number of remote drivers may be selected by writing to a suitable latch. In this condition, the bus lines are connected to an interrupt line so as to monitor external events such as a reverse power protection trip.

Quasi-static bus

Both address and data buses are buffered so as to free the I/O bus wiring from the normally continuous trains of pulses from the processor area. The I/O address is buffered by octal latch IC117 while the two-way data is buffered by octal transceiver IC118. For the latter, data direction is determined by pin 1. When this is taken low data is received onto the processor bus, and when taken high data is sent out on the I/O bus. When IC121a pin 19 is taken high both buffers are disabled and the two buses are isolated.

GPIB interface

The function of IC113 is to provide communication between the instrument and the General Purpose Interface Bus (GPIB). The IC is a talker/listener which, in conjunction with transceivers IC115 and IC116, implements all the necessary GPIB functions for the instrument. (Details of the functions are given in Chap. 3-2 of the Operating Manual.) It is processor controlled and has capabilities which include data transfer, handshake protocol, talker/listener address recognition, service request and serial poll.

The interface takes care of data transfer as well as decoding control messages. Control messages and addresses are passed on the data bus by means of the handshaking process with ATN (attention) asserted to differentiate them from data. The IC also performs address

recognition. When its own address is recognized (set from the front panel and then via the RS0 to RS2 inputs), the data on DIO lines 6 and 7 is decoded to determine whether the instrument is being addressed as a talker or a listener. When designated a talker, the interface transfers data from the processor by means of a talk handshake to listeners via an internal register to the transceivers configured to send. When designated a listener, data is received via the transceivers by means of the listen handshake and stored in an internal data register.

Data outputs and inputs are via transceivers IC115 and IC116 with the direction of data transfer controlled by the T/R1 line being taken high for outputs and low for inputs. The sole function of T/R2 is to set the bus management EOI line low for reception or high for transmission. The GPIB clock for the interface is supplied by invertor IC129a, R124 and C137. The CR time constant sets the frequency to 1 MHz while the on/off thresholds of the Schmitt provide a square wave which is further shaped by IC129b.

CONTROL: AUDIO SYNTHESIZER (AA1/2 sheet 2)

Circuit diagram: Fig. 7-3.

The instrument is provided with the facility to generate a single tone (two tones if the second LF oscillator option is fitted) at any frequency from 0.1 Hz up to the band limit of 500 kHz in 0.1 Hz increments.

Two different normalised waveforms are stored in an EPROM look-up table which, under the control of a custom ASIC, is periodically addressed to regenerate the waveform in discrete steps via a D-A converter. Simple interpolation between the quantized levels is done by a low-pass filter which also helps to reject high order harmonics. The block diagram of the audio synthesizer is shown in Fig. 4-2-2.

Controller and waveform store

The internal audio source is controlled by ASIC IC201 (IC209 for osc 2). This coordinates the addressing of the waveform store EPROM with the generation of the required waveform and frequency. IC202 is a 64 kbyte 16-bit EPROM which holds digitized complete cycles of two normalised periodic waveforms. Multiplexer IC208 (three NAND-gates, IC208b, c and d on board AA1) selects which waveform is obtained from the EPROM by modifying the most significant bit of the address. (The remaining two sections of IC208 are unused.) By using the 1.6777216 MHz REF clock normally to IC209 and inverted to IC201 there are no conflicts in waveform selection (see Table 4-2-1).

Because the technique is totally digital and is clocked synchronously from the 104.8576 MHz on-board reference, the audio frequency generated has the same frequency stability as the selected standard.

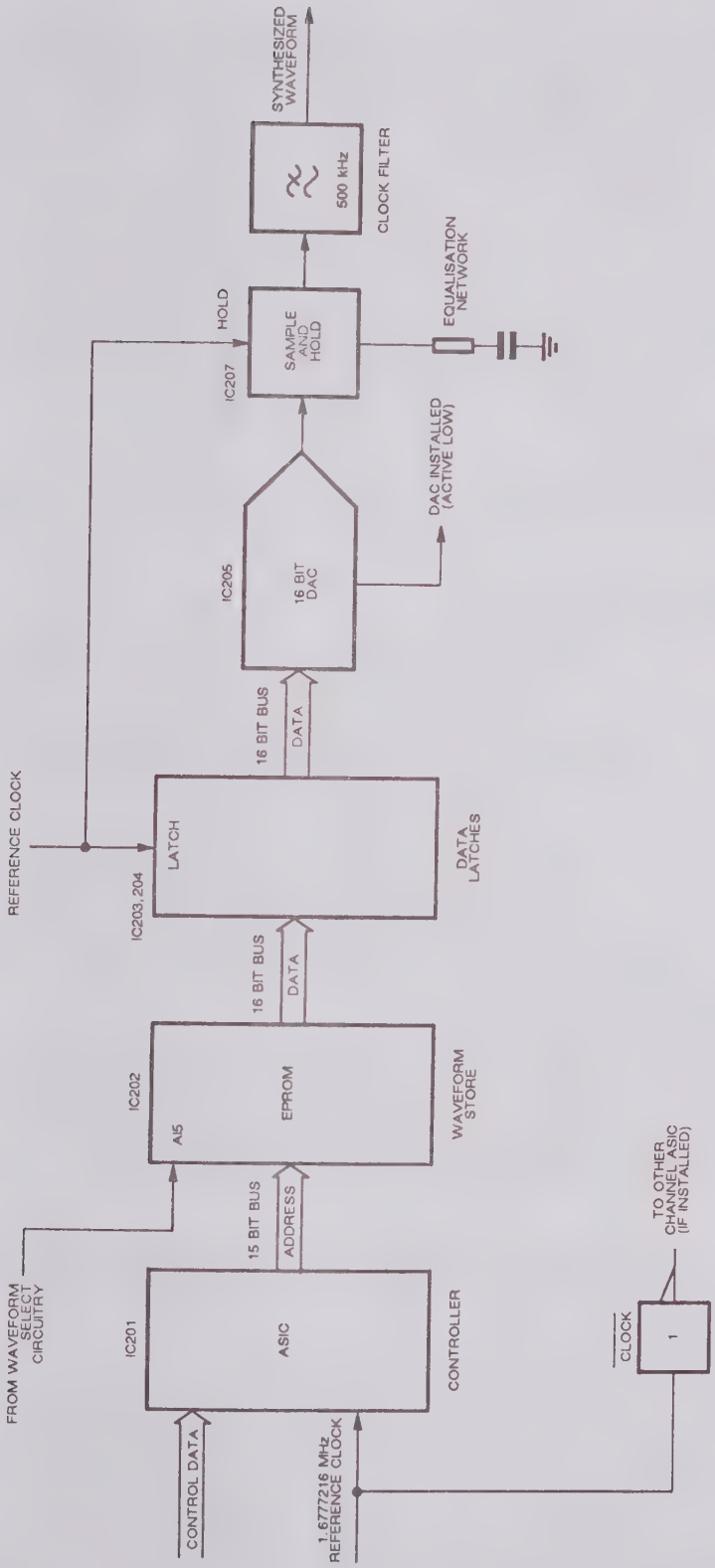

Fig. 4-2-2 Audio synthesizer

TABLE 4-2-1 WAVEFORM ADDRESS SELECTION - AA1/2

IC208 pin 1 (9)	IC208 pin 2 (5)	Effect
0	-	Waveform 1 on internal audio osc 1
1	-	Waveform 2 on internal audio osc 1
-	0	(Waveform 1 on internal audio osc 2)
-	1	(Waveform 2 on internal audio osc 2)

Pin numbers in brackets refer to board AA1.

Note...

Internal audio osc 2 is only available when the correct components e.g. IC209, IC212, have been loaded into the sockets on the boards.

Audio D-As and clock filter

The data from the EPROM is held for one clock cycle by latches IC203 and IC204 (IC210 and IC211 for osc 2) to allow the 16-bit D-A converter IC205 (IC212) to operate. Holding the data presented to each D-A converter in turn enables the ASICs to work on the opposite edges of the REF clock. This therefore enables the simultaneous generation of two independent frequencies and waveforms. Buffer IC206 (IC213) feeds to the output deglitcher.

A sample and hold gate IC207 (IC214) is used to deglitch the output from the D-A converter which is prone to generating glitches as the data patterns change on its inputs. R220, R223 and C243 (R221, R222 and C244) provide a degree of equalization at the top frequency which otherwise falls off due to the limited bandwidth of IC205 (IC212). R217 and R218 limit the device dissipation of IC207 (IC214).

The following 500 kHz low-pass clock filter is provided to remove the clock frequency and its harmonics from the final signal. The filter is designed to be -80 dBc down on the audio frequency above 1.6 MHz. R204 and R205 (R209 and R210) terminate the filter in the required load impedances. Filter output is fed to the audio multiplexers (sheet 3).

CONTROL: EXT MOD AND AUDIO OUTPUT (AA1/2 sheet 3)

Circuit diagram: Fig. 7-4.

Two external inputs, EXT MOD 1 and EXT MOD 2 are provided which, together with the two internal sources, allow up to four independent tones to be superimposed on the carrier. This facility is made use of in the dual composite modulation mode. The two direct paths are user-selectable. Choosing the AC route allows operation down to 10 Hz while the DC route enables operation to DC. The ALC (Automatic Levelling Control) enables the instrument to accept a wide range of input modulating waveform amplitudes without losing calibration. The block diagram for the EXT MOD 1 conditioning circuit is shown in Fig. 4-2-3. EXT MOD 2 is similar.

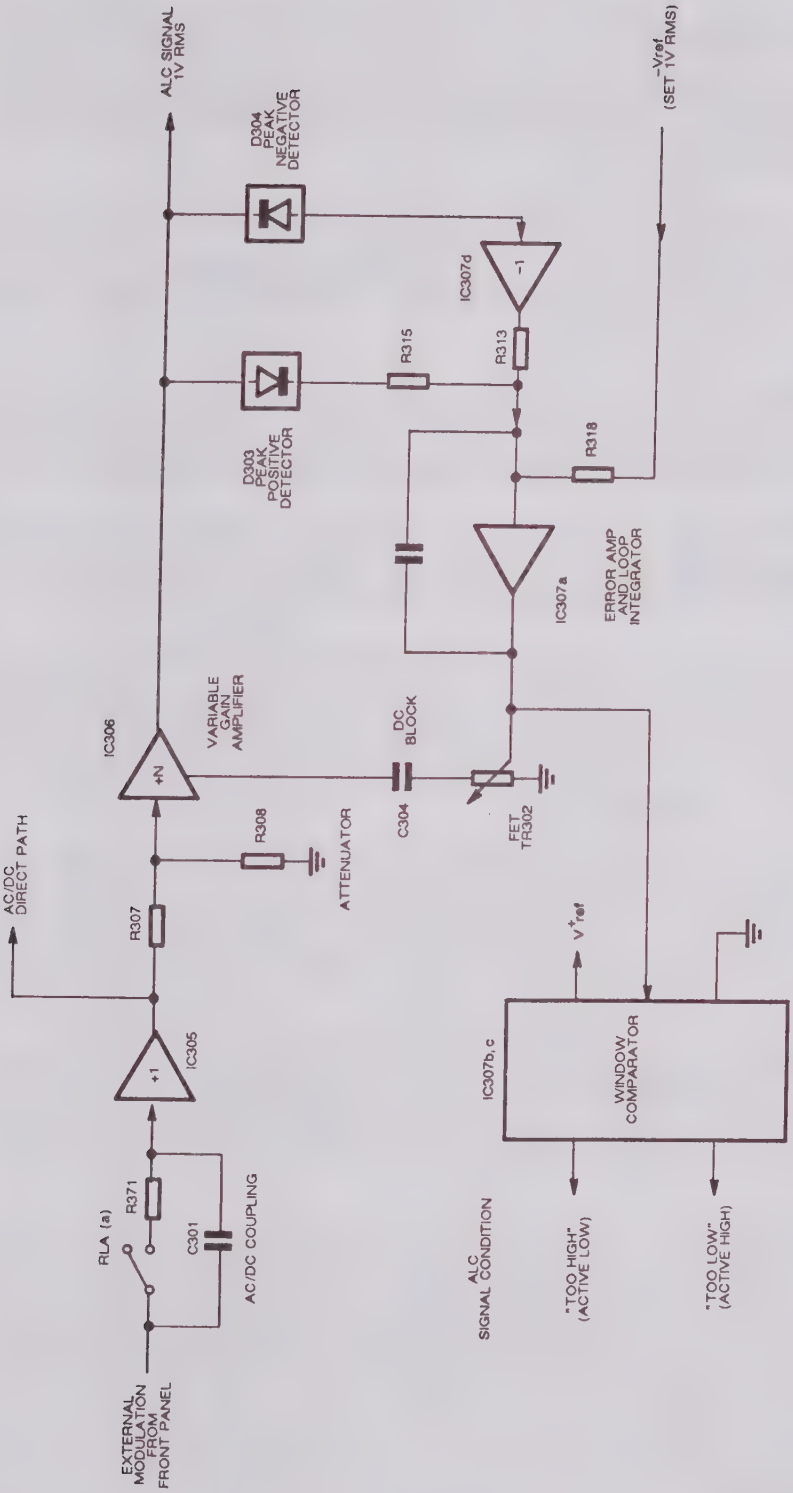

Fig. 4-2-3 EXT MOD 1 conditioning circuit

Modulation channels

As the two modulation channels are identical in operation, only one is described below in detail, that connected to the EXT MOD 1 INPUT. The only difference between the two channels is in component numbering.

External modulation enters board AA1/2 on contact 2 of PLAJ. With RLA(a) contact open the AC path through C301 is selected, when closed the capacitor is by-passed and operation down to DC is enabled. R371 prevents contact failure during the switching operations. Relay selection is shown in Table 4-2-5.

The DIRECT 1 PATH is buffered by IC305 to provide a low drive impedance for the ALC and the analogue multiplexer array IC311 to IC315. Diodes D317 and D318 protect the input of the multiplexers from excessive voltage excursions above +5 V or below -5 V.

For an AC coupled signal, automatic levelling to 1 V RMS is achieved by modifying the gain around non-inverting amplifier IC306 by using FET TR302. The buffered signal is attenuated by R307 and R308 to bring it within the operating range of the ALC.

The output is then sampled by peak-positive (D303 and C305) and peak-negative (D304 and C306) detectors. A measure of the peak-to-peak level is obtained by inverting the voltage from peak-negative detector IC307d and summing this with the peak-positive voltage at pin 2 of IC307a which also acts as the error amplifier/integrator for the levelling loop. D301 prevents error integration in the wrong direction.

The voltage from the error amplifier is used to drive the gate of FET TR302 to a point where the current flowing through diode D302 equals the sum of the currents through R313 and R315 which correspond to the peak detected levels. D319 and D320 on the ALC 1 PATH protect the inputs of the analogue multiplexers against excessive signal levels which may be generated while the loop is settling.

R373 and R310 provide a common AC signal between the gate and the drain to linearise the FET characteristics at high drain-source resistance. R312 prevents the loop from becoming unstable for closed loop gains of less than 10. C304 acts as a DC block to suppress any unwanted DC offset injection into the loop.

IC307b and c form a window comparator which detects when the error amplifier output exceeds the boundary set by the maximum pinch-off voltage of the FET. R321 and R322 provide hysteresis around the comparator to prevent multiple-edge generation. The outputs from detectors D305 and D306 on the ALC HIGH and ALC LOW lines are attenuated to logic levels by R323, R324 and R325, R326 respectively to provide status interrupts to the main processor via IC108 and IC110 (sheet 1).

LF multiplexers

LF multiplexers IC311 to IC315 allow each of the FM, AM and audio output chains to connect to one of many user-selectable internal sources. This gives the user maximum flexibility in configuring and monitoring the sources of modulation within the instrument.

The analogue multiplexers are controlled by D-type latches IC302, IC303 and IC304. The latch decoding is shown in Table 4-2-2 together with the source selection decoding shown in Tables 4-2-3 and 4-2-4. IC316, IC317 and IC318 buffer the signals from multiplexers IC311 to IC315 and provide a low drive impedance to IC402 (sheet 4) and IC502 (sheet 5).

TABLE 4-2-2 LATCH DECODING - AA1/2

Destination	Select table	IC and control lines used
Audio output	3	IC304 D0 > D2
FM1	4	IC302 D0 > D2
FM2	4	IC302 D3 > D5
AM1	4	IC303 D0 > D2
AM2	4	IC303 D3 > D5

TABLE 4-2-3 SOURCE SELECTION DECODING - AA1/2

IC304 D2	D1	D0	Source selected
0	0	0	Int audio gen 1
0	0	1	Int audio gen 2
0	1	0	Ext 1 ALC coupled
0	1	1	Ext 2 ALC coupled
1	0	0	FM composite
1	0	1	AM composite
1	1	0	Earth
1	1	1	Earth

TABLE 4-2-4 SOURCE SELECTION DECODING - AA1/2

IC302 and IC303 D2/D5	D1/D4	D0/D3	Source selected
0	0	0	Int audio gen 1
0	0	1	Int audio gen 2
0	1	0	Ext 1 ALC coupled
0	1	1	Ext 2 ALC coupled
1	0	0	FM composite
1	0	1	AM composite
1	1	0	Earth
1	1	1	Earth

TABLE 4-2-5 RELAY CONTROL - AA1/2

IC number and data line	Relay operated	Function when contact closed
IC303 D6	RLA	Ext 1 DC coupling
IC303 D7	RLB	Ext 2 DC coupling
IC304 D5	RLC	Inserts 48 dB into LF output circuit

LF output

The audio to the LF OUTPUT socket is provided to enable the state of the modulation within the instrument be monitored. When in LF generator mode, this output is adjustable from 5 V down to 100 µV into a nominal 600 Ω load impedance (less into 50 Ω). A floating earth is provided to break up any hum loop which may be present between the instrument and any external measuring devices. The block diagram for the audio output stage is shown in Fig. 4-2-4.

IC319 is a 12-bit multiplying D-A converter which together with IC320 gives fine adjustment for the eventual audio output from the front panel. R354 and C313 form a lead network to improve high frequency stability. R335, R356, R357 and R358 form a coarse attenuator network which is tapped at 0, 12, 24 and 36 dB attenuations by IC321 pins 13, 14, 15, and 12 respectively. The audio signal is then buffered by IC322 and fed into the low impedance driver.

IC324 is a current buffer which boosts the output drive capabilities of IC323. The DC offset and gain variations of IC324 are corrected by enclosing the device within the feedback loop of IC323. R361 sets the output characteristics of the device.

R365 and R366 form a 48 dB L-pad which is used together with the fixed 12, 24 and 36 dB pads to set coarse attenuation of the eventual output level. R362 and R363 form a floating earth guard (PLAP contact 9) to facilitate the reduction of earth loop generated signals that may be present between the instrument and external measuring devices. Note that this works in conjunction with a 1 Ω resistor positioned on the earth of the LF OUTPUT socket on the front panel.

Sweep functions

The sweep facility of the instrument allows discrete increments of the RF frequency, RF level or audio level over user-specified limits and time. The block diagram of the sweep function is shown in Fig. 4-2-5.

All sweeps are digitally based and therefore each selected parameter changes in a discrete step for a unit length of time. The greater the number of steps over the preset limits, the smoother the sweep becomes.

Sweep ramp and markers are provided to give a degree of synchronisation to an external measuring device such as an XY display or plotter. Again the ramp is digitally generated, each step corresponding to an increment of a parameter.

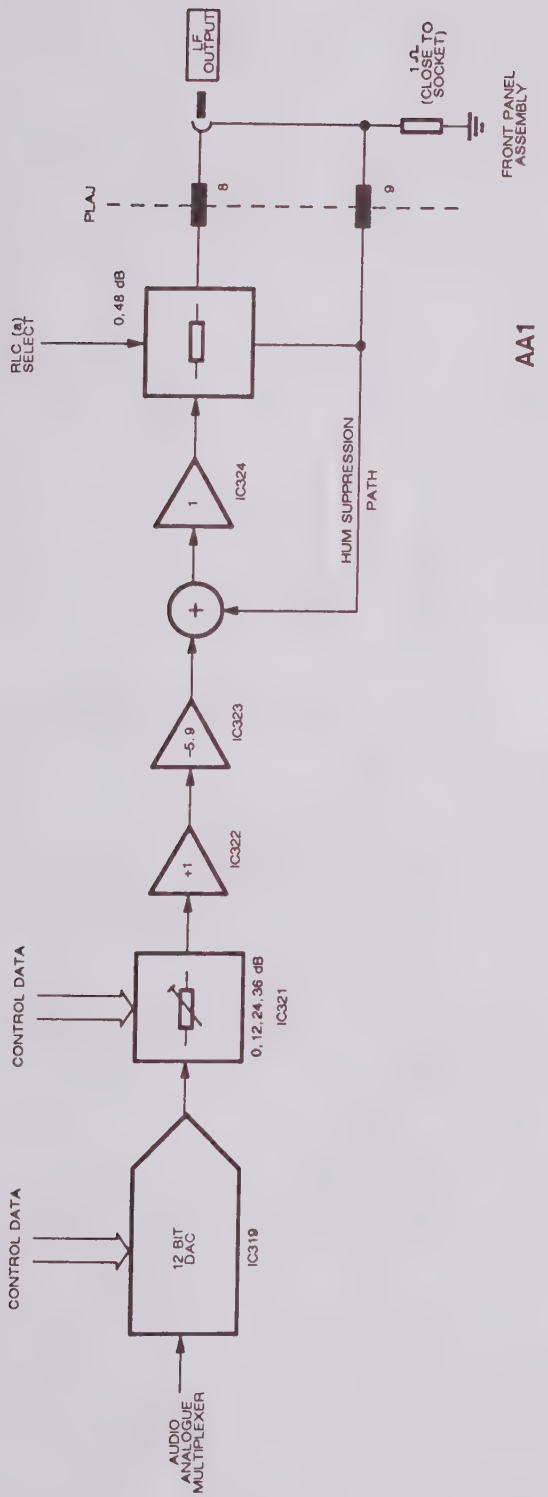

Fig. 4-2-4 LF output stage

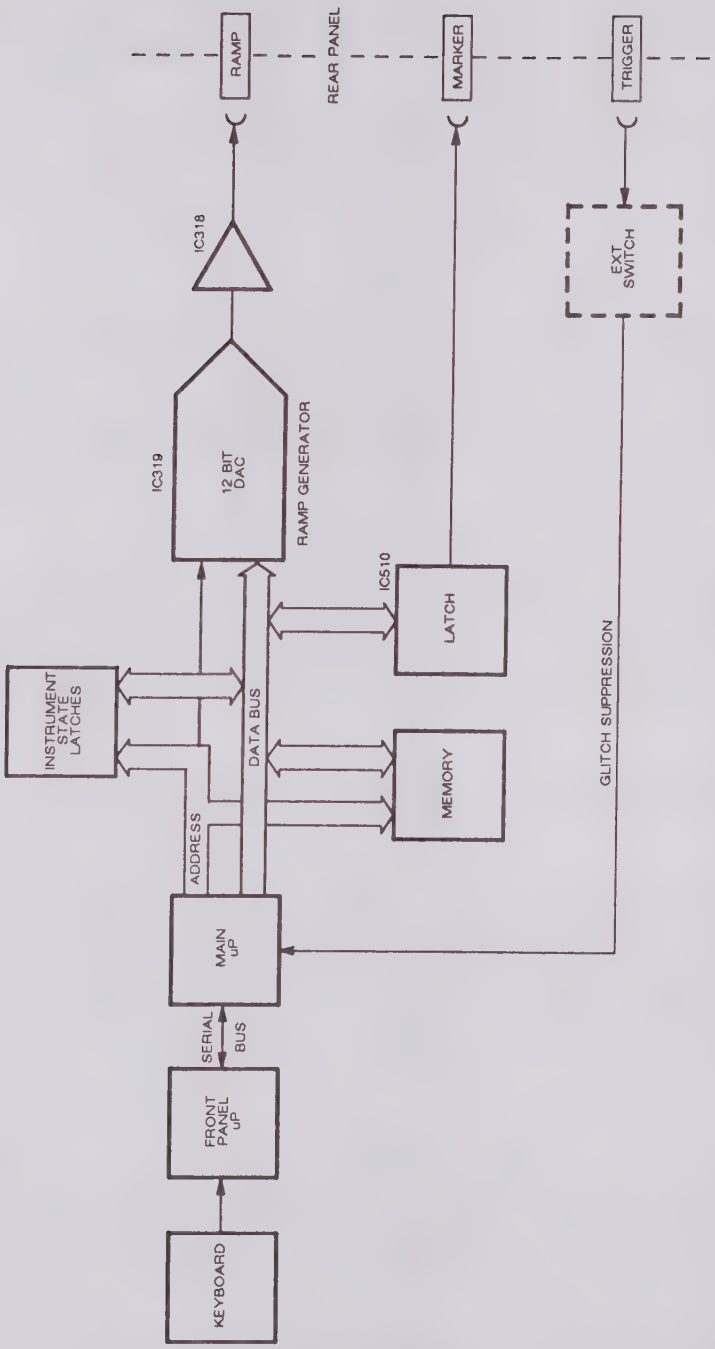

Fig. 4-2-5 Sweep function

The rear panel SWEEP TRIGGER input is used as a general 'start event' input. This facility allows the start of the sweep to be synchronised with an external device. The default is SINGLE SWEEP triggered from a screen menu soft key.

The sweep ramp is generated by IC319 to IC318b pin 6. As the requested sweep parameter is changed internally the D-A converter is updated to the next appropriate value to maintain synchronisation. The sweep is complete when the ramp output reaches +10 V. The magnitude of the steps in the ramp is governed by the number of steps requested by the user. R549 protects the SWEEP RAMP output against excessive input voltages and sets an output impedance of 600 Ω.

The sweep marker is generated by IC510 pin 6 (sheet 6). This line pulses high as the sweep passes through the selected marker point set up by the user. R550 protects the output against incorrect connection to other devices.

External sweep trigger (sheet 1) interrupts main processor IC101 (via INT3) which then takes the necessary action to initiate the requested function. When selected, a logical low triggers the instrument. R107 and C131 prevent spurious triggering due to glitches and noise. R108 permits operation by the closing of a simple external switch (e.g. a footswitch).

CONTROL: FM AND ΦM DRIVE (AA1/2 sheet 4)

Circuit diagram: Fig. 7- 5.

FM adjusts the instantaneous RF frequency in direct sympathy with the modulating signal. The amount of frequency deviation is directly proportional to the magnitude of the modulation source. With phase modulation the frequency deviation is also proportional to the frequency of modulation. The block diagram of the FM and ΦM drive is shown in Fig. 4-2-6.

For moderate modulation rates the signal is injected straight onto the VCO tune line after suitable scaling by D-A converters (giving fine control) and fixed attenuators (giving coarse control). The block diagram of the FM and ΦM drive is shown in Fig. 4-2-6.

Inside the loop bandwidth this method is not valid as the loop cannot distinguish between FM and other VCO frequency errors. It would therefore try to compensate for the modulation tone by returning the carrier back to the original requested frequency. A digital system is used to overcome this effect which also has the benefit of extending the modulation range down to DC.

The modulation is sampled by a 1-bit oversampling A-D converter whose output controls the synthesizer gate array controller ASIC in such a way as to offset the carrier frequency in proportion to the magnitude of the modulation. The speed at which the ASIC can perform this function sets a limit to the overall bandwidth of the system. At frequencies above the loop bandwidth the analogue system dominates, see Fig. 4-2-7.

In both systems phase modulation is provided by a passive high-pass integration network which effectively increases the drive to the varactor with increasing modulation frequency.

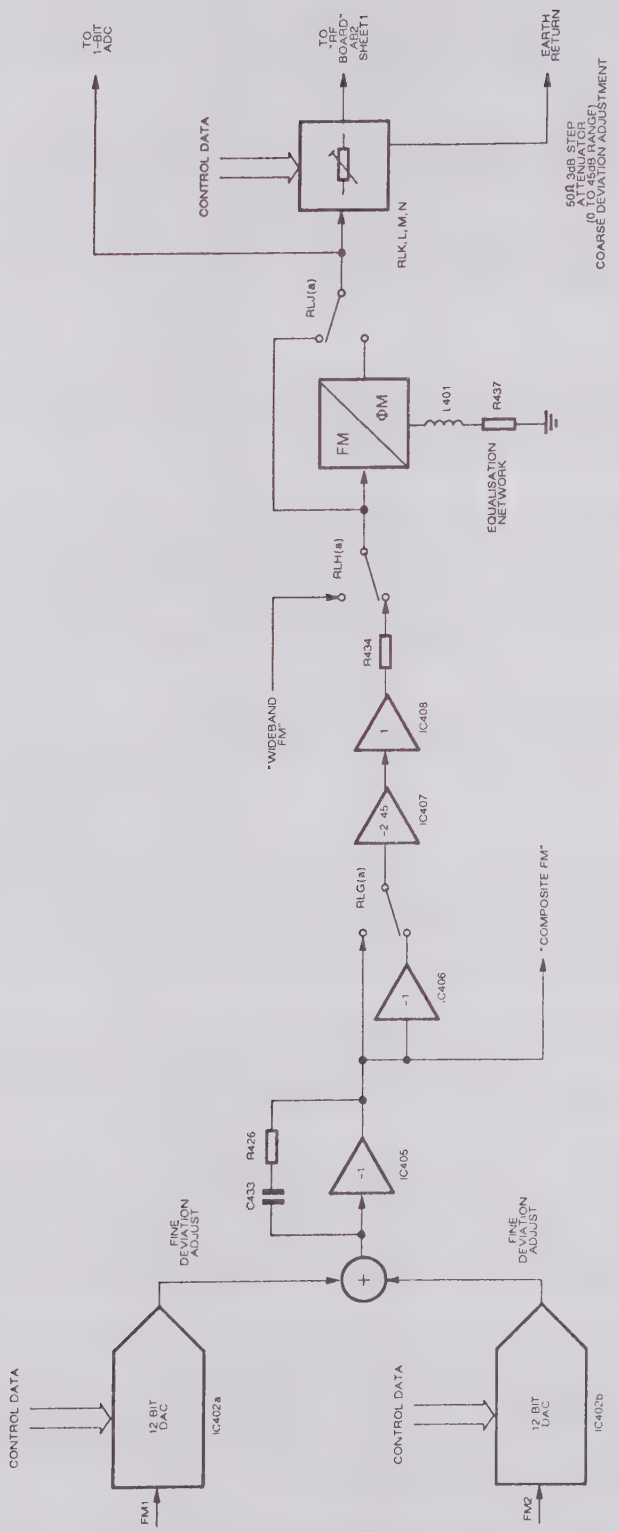

Fig. 4-2-6 FM and ΦM drive chain

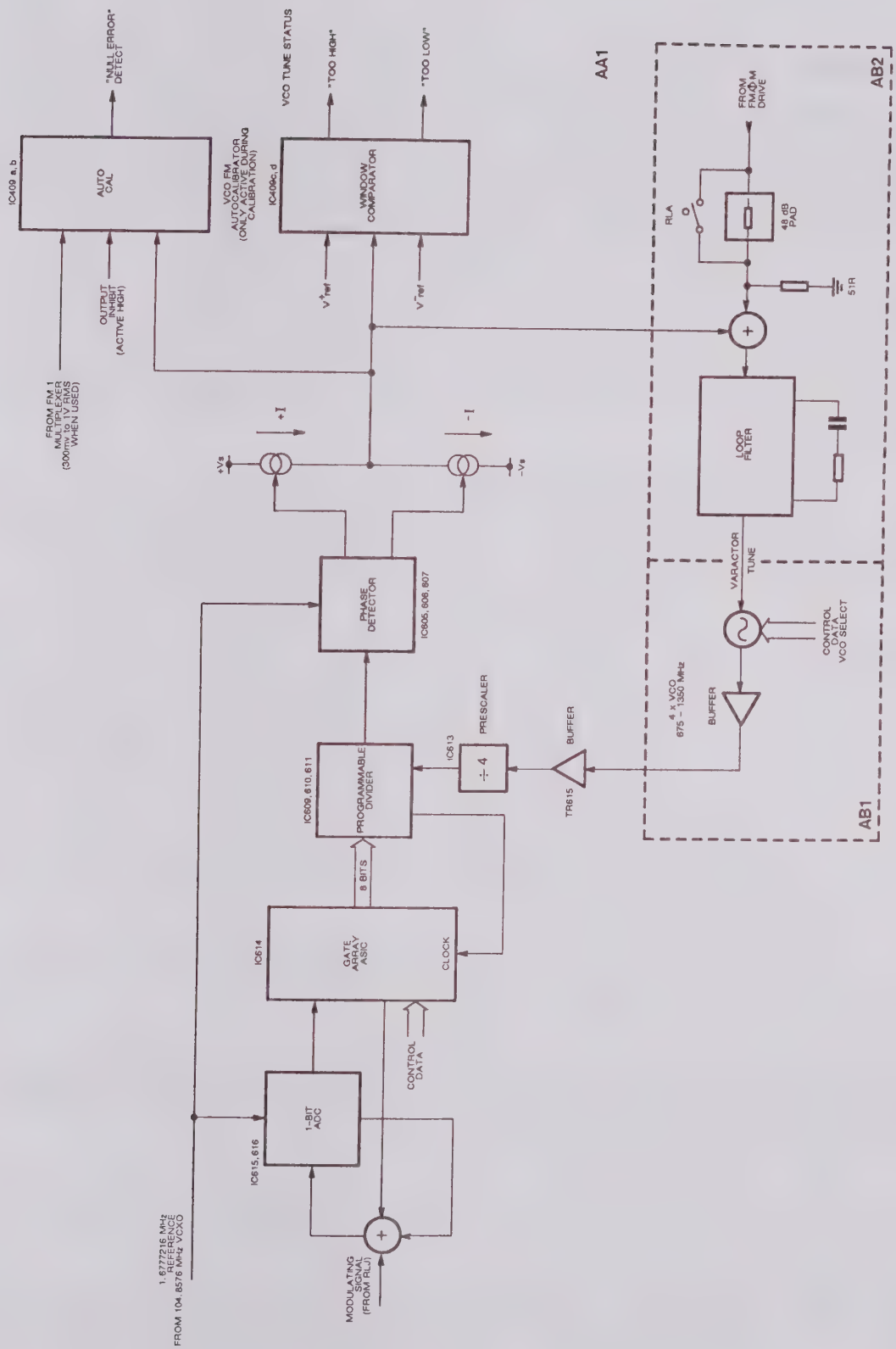

Fig. 4-2-7 Frequency synthesis with FM/ΦM and autocalibrator

Operation

Outputs from analogue multiplexers IC312 for the FM1 signal and IC313 for the FM2 signal (sheet 3) are fed to IC402, a dual 12-bit multiplying D-A converter, which together with IC403 and IC404 acts as a fine level control. Coarse setting is achieved by a group of fixed passive pads giving attenuation on this board of up to a maximum of 45 dB. R463 and C455 act as a local supply line filter which is also used by IC319 (sheet 3).

Composite FM (the algebraic sum of FM1 and FM2) is derived by the addition of two signals, at pin 2 of IC405, by resistors R424 and R425. Since these resistors are of equal value, each channel has an equal weighting on the eventual FM output. R426 and C433 are used to improve the HF stability. IC406 is a signal invertor which corrects the phase relationship between the incoming modulating signal and the eventual output. Relay contact RLG(a) selects the appropriate path. C434 reduces the noise bandwidth of the drive chain by dropping the gain at high frequencies.

Conversion to a low impedance (to drive into the 50 Ω coarse step attenuator) is achieved by IC407 and IC408. IC407 is a current buffer and is used to boost the output drive to IC408. Any errors due to DC offset and gain variations within IC408 are accommodated by enclosing it within the feedback loop of IC407. R431 and C435 improve HF stability within the loop.

Coarse attenuation is set in 3 dB steps by R438 to R449 (and R34 to R36 on AB2/2, sheet 1). Relays RLK to RLN (and RLA on AB2/2) are used to select the appropriate values. Each pad is a pi-configuration which maintains a 50 Ω impedance to ensure wide band operation into many megahertz. R436 and R437 form a pseudo-floating earth to reduce any hum-related signals which may be present on the earth of the attenuator on the board. It operates by feeding a common mode signal back onto the output of IC408 to cancel that present on the floating earth. IC411 controls the relays by means of data from latch IC412. R450 limits the current flowing through the coils. The earth for the 24 dB pad is split between the AA1/2 and AB2/2 boards to reduce effects of hum loops within the instrument chassis. C446 helps to linearise the 24 dB pad at HF by compensating for the inductance incurred by the cable length between PLAN contact 33 and PLBJ contact 15 (AB2/2).

Wideband FM comes onto AA1/2 on PLAR contact 2 and is selected by operation of relay contact RLH(a). Since the passive attenuator can only be adjusted in 3.01 dB steps, the requested WBFM deviation is adjustable in equivalent steps.

FM to ΦM conversion is achieved by C436 and R437 which form a high-pass 6 dB/octave equalization network. L401 extends the linearity of the converter by peaking the response close to 20 kHz. Using a totally passive network helps to reduce any distortion products which may be generated by an equivalent active network.

VCO FM tracking autocalibration is performed by IC409a and b and associated circuitry (see 'Synthesizer operation' for details). Forward biasing D409 suppresses the operation of the autocalibrator and prevents unnecessary interruption of the main processor.

Digital FM and ΦM at low modulation frequencies is achieved by the combination of the 1-bit oversampled A-D converter formed by IC615, IC616 (sheet 7) and the synthesizer ASIC IC614. The A-D converter samples the modulation source at a high rate and passes the information to the gate array controller in a high speed serial data stream. The ASIC then modifies the ECL counters to change the instantaneous frequency of the carrier.

CONTROL: AM DRIVE AND RF LEVEL (AA1/2 sheet 5)

Circuit diagram: Fig. 7-6.

The amplitude modulator adjusts the magnitude of the RF carrier in direct sympathy with a modulating signal. The block diagram of the RF level setting is shown in Fig. 4-2-8. It is also used to provide electronic attenuation of the RF output of the generator.

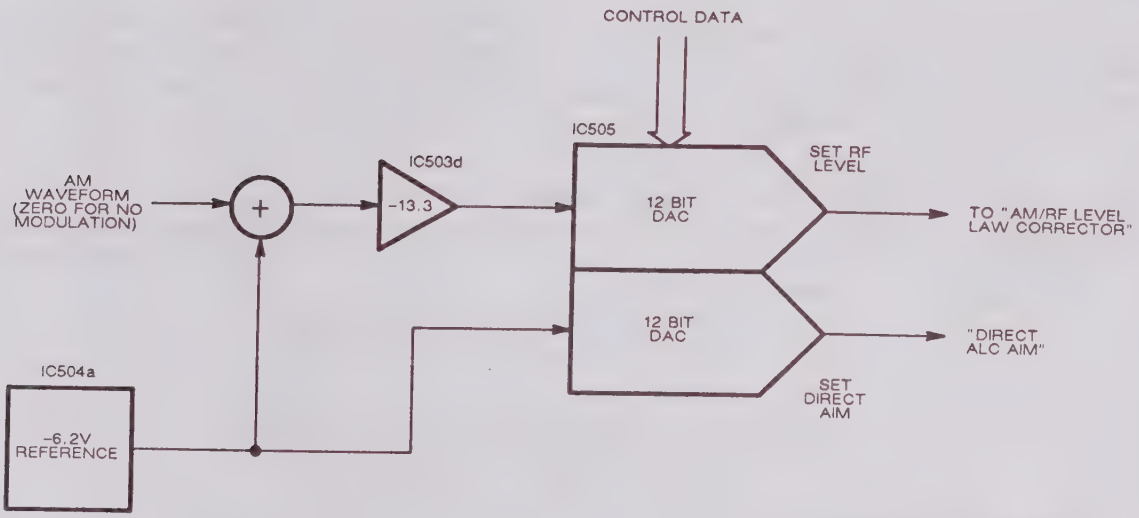

Fig. 4-2-8 RF level setting

The AM drive therefore provides a DC level corresponding to the average RF level with the AC modulation superimposed. The AM drive circuit produces a waveform with independent control of both parameters. The block diagram of the AM control is shown in Fig. 4-2-9.

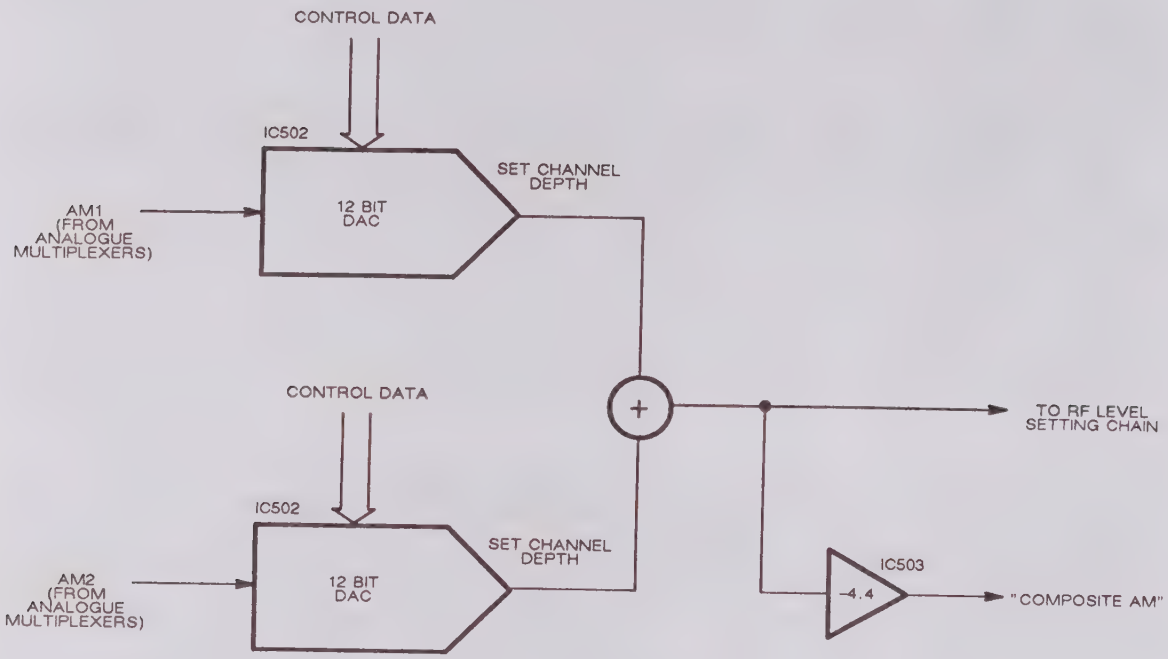

Fig. 4-2-9 AM control

Modulation depth

Outputs from the analogue multiplexers IC314 for the AM1 signal (sheet 3) and IC315 for the AM2 signal are directed to IC502, a dual 12-bit multiplying D-A converter which controls the depth of modulation imparted to the RF carrier. AM composite (the algebraic sum of AM1 and AM2) is generated by adding the two signals from IC503a and b using resistors R501 and R502. Since these resistors are of equal value each channel is given equal weighting. IC503d sums and inverts the signals to maintain the correct phase relationship between the envelope on the carrier and the selected modulation source.

Overmodulation, i.e. depth in excess of 100%, is suppressed in normal operation by software limiting. However, this does not protect against over-modulation due to overloading the drive chain. It is important to bear this in mind when using composite or quadruple modulation where the indexes and depths can easily exceed the capabilities of the measuring receiver, if due care is not taken. Maximum depth of modulation for each type is shown in Table 4-2-6.

The RF level is set by a DC level from 12-bit D-A converter IC505 which eventually controls the amount to attenuation set within the AM modulator, which also acts as the electronic attenuator for the RF carrier on the AB2/2 board.

TABLE 4-2-6 MODULATION TYPE VERSUS MAXIMUM DEPTH - AA1/2

Modulation scheme	Normal maximum depth of modulation	
	AM1	AM2
Single	0 - 99.9%	Not used
Dual	0 - 99.9%	Not used
Composite	0 - 99.9%	99.9 - 0%
Quad	0 - 99.9%	99.9 - 0%

A -6.2 V reference voltage is derived from IC504a. This IC is configured to provide a fixed amount of current flowing through Zener diode D502 thus reducing the influences of Zener voltage drift with temperature. Working from this reference, the AM signal is mixed with the DC reference (which governs the average RF level) at pin 13 of IC503d.

Programming D-A converter IC505 enables attenuation of both the AM and DC simultaneously, keeping the ratio between the two constant. This is important as the depth of modulation is defined as:

$$\text{AM depth} = \frac{\text{Peak to peak of RF envelope}}{\text{Trough to trough of RF envelope}} \times 100\%$$

$$= \frac{\text{Magnitude of modulation of the RF envelope}}{\text{Magnitude of the average RF envelope}} \times 100\%$$

By using two separate D-A converters, IC502 and IC505, control of the depth of modulation can be performed independently of the requested RF level. By injecting a fixed current from IC507 pin 23, any accumulated offset voltages can be cancelled at the input of IC506b pin 6. This therefore corrects the denominator term in the above equations for the depth of modulation. R515 provides a negative bias to IC506b to allow for bipolar correction from IC507 pin 23.

IC505 pin 22 also produces a direct ALC aim signal, from the same voltage reference, which is used to hold the RF ALC loop. This facility is only used when the pulse modulator is operating as otherwise the loop would try to compensate for the lack of RF level during the off period.

CONTROL: AM AND RF LAW CORRECTION (AA1/2 sheet 5)

Circuit diagram: Fig. 7-6.

The generation of a perfectly undistorted AM carrier requires a perfectly linear detector which detects the magnitude of the carrier. In practice no such device exists and all schemes are prone to becoming non-linear at some operating level. The purpose of this circuit is to predistort the ALC REF signal to compensate for the diode law of the detector at low RF levels. The transfer function is shown in Fig. 4-2-10.

Normal carrier levels can be considered to be an AM envelope which is controlled by a DC modulating voltage. Therefore the corrector is also used when setting a carrier level but without any set amplitude modulation. Fig. 4-2-11 shows the block diagram of the law correction.

Operation

The drive waveform for the amplitude modulator is pre-distorted by IC506b, IC507 and IC508. The circuit compensates for the square law characteristics of the diode detector scheme at low RF levels. This results in a slightly distorted envelope at the troughs of the AM carrier which corresponds to the points of minimum RF level.

The transistor in IC508 shown at the right-hand side (pins 6, 7 and 8) provides the required pre-distortion by injecting additional drive current to the AM drive at low levels. At higher levels this current (set by R519 and pin 24 IC507) is swamped by the natural action of the transistors. The left-hand transistor (pins 1, 2 and 3) compensates for temperature effects within the base-emitter junctions of the transistors. Since both devices are fabricated within in a single package, good temperature tracking is assured.

Envelope feedback is through R516 and R517. The ratio of these resistors ensures that the average envelope is sampled from both transistors. IC506b is the error amplifier which closes the pre-distortion loop. C561, in conjunction with R516, provides an improvement in HF stability. R520 and R518 provide the necessary bias conditions for correct operation of the transistors within IC508.

The RF/AM drive signal is bandwidth limited by L506 and C423 before being sent via contact 28 of PLAN as the ALC reference signal to RF board AB2/2.

CONTROL: REFERENCE PLL (AA1/2 sheet 6)

Circuit diagram: Fig. 7-7.

The frequency standard provides an accurate and stable frequency reference for the instrument. This is used to phase lock the internal 104.8576 MHz VCXO from which all internal clock signals and the RF output frequency are derived.

The internal oven-controlled crystal standard is factory set to 10 MHz which is divided to 1 MHz and used to lock the 104.8576 MHz VCXO. The FREQ STD IN/OUT socket on the rear panel then operates as an output port providing a user-selectable 1, 5 or 10 MHz to synchronize any external measuring equipment. The block diagram of internal standard operation is shown in Fig. 4-2-12.

The instrument can accept a user-selectable 1, 5 or 10 MHz external signal as a frequency standard. Each frequency is divided to the required 1 MHz necessary to lock the VCXO. In this mode the FREQ STD IN/OUT socket on the rear panel becomes an input port accepting a waveform of suitable drive levels. The internal standard is also switched off in this mode to prevent any unnecessary crosstalk or beating occurring which would otherwise impair the short term stability of the standard signal. The block diagram of external standard operation is shown in Fig. 4-2-13.

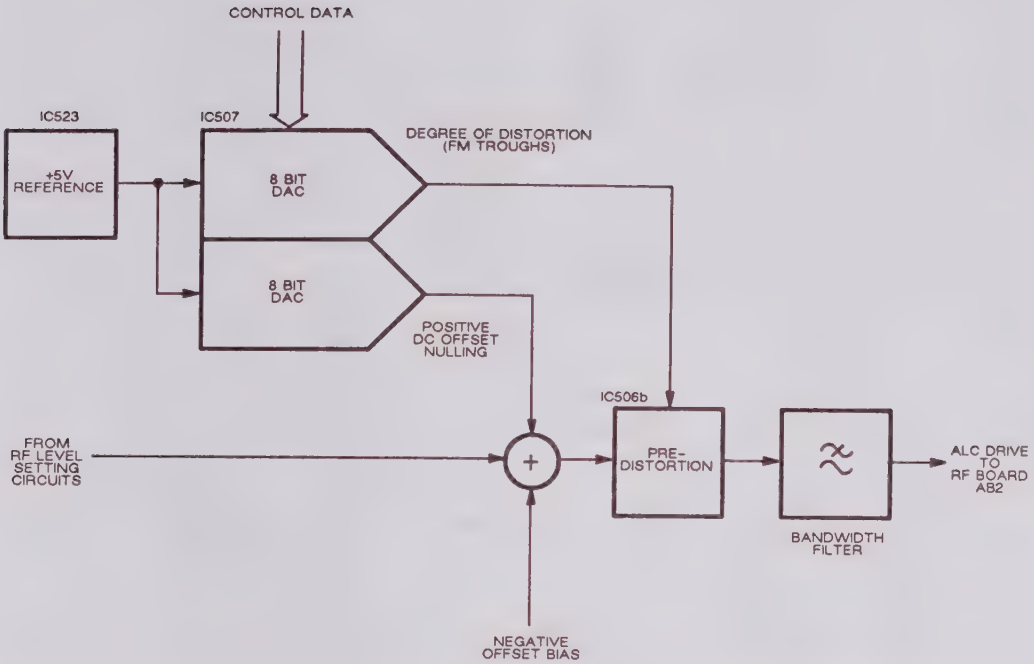

Fig. 4-2-10 Amplitude modulator/electronic attenuator transfer function

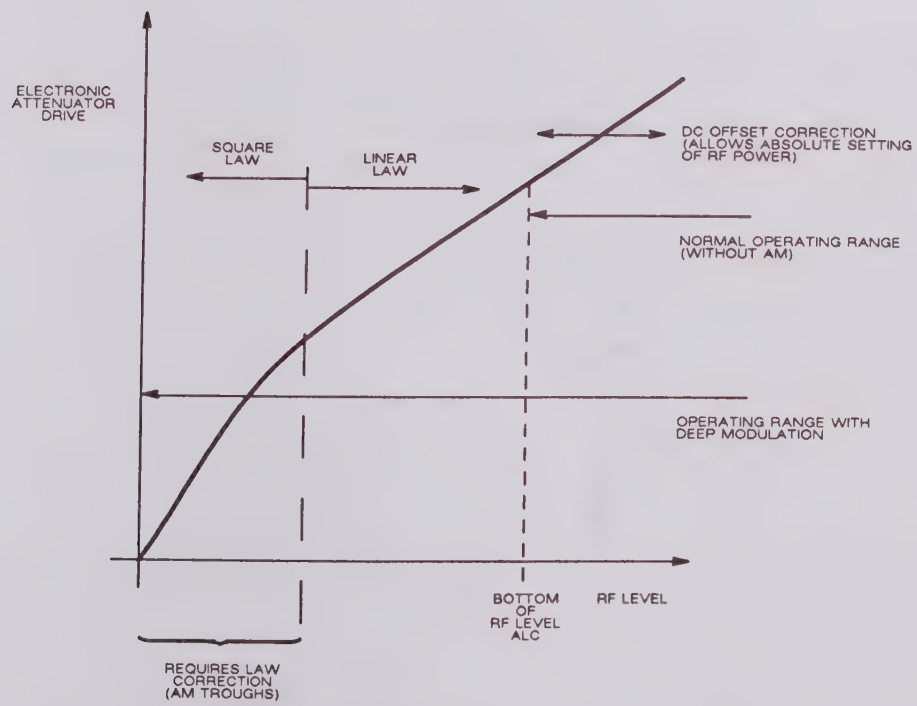
ELECTRONIC ATTENUATOR DRIVE
SQUARE LAW
LINEAR LAW
DC OFFSET CORRECTION (ALLOWS ABSOLUTE SETTING OF RF POWER)
NORMAL OPERATING RANGE (WITHOUT AM)
OPERATING RANGE WITH DEEP MODULATION
BOTTOM OF RF LEVEL ALC
RF LEVEL
REQUIRES LAW CORRECTION (AM TROUGHS)

Fig. 4-2-11 Law correction

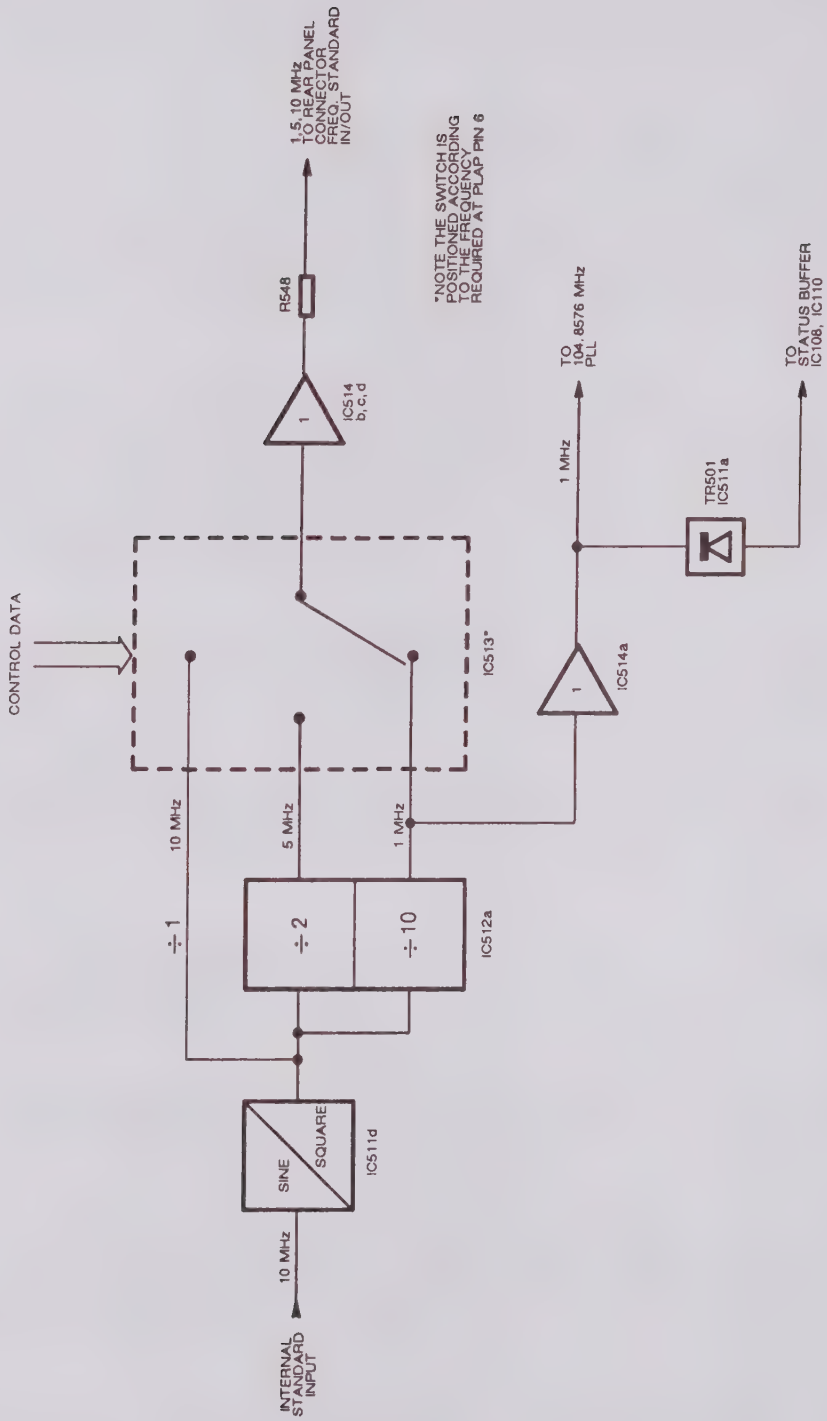

Fig. 4-2-12 Internal standard operation

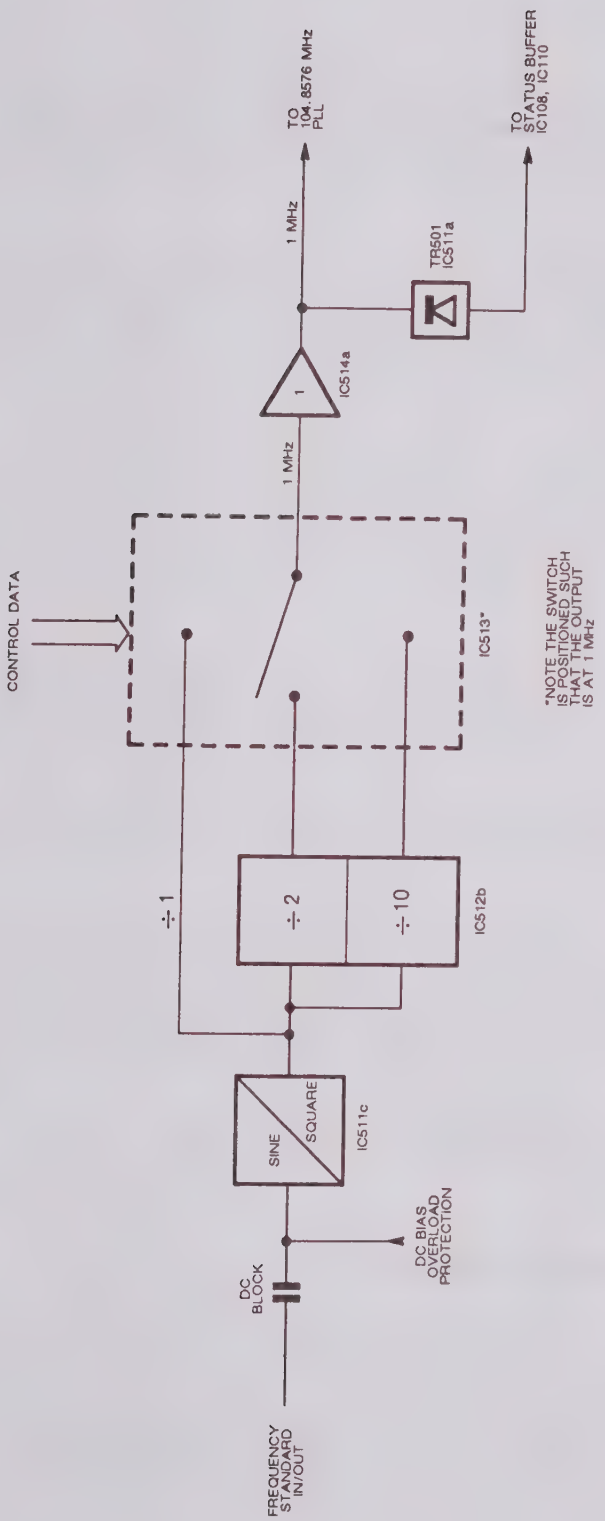

Fig. 4-2-13 External standard operation

Operation

The external standard is fed in on the EXT STD line from PLAP contact 6 and is squared to logic levels by IC511c. Resistors R521 and R522 provide DC bias to the AC coupled signal to ensure efficient switching at moderate input levels. Diodes D510 and D511 protect the input against adverse signal levels.

The internal standard is fed in on the INT STD line from PLAP contact 8. No DC biasing is required for this signal as the waveform from the OCXO (located on AR2) swings about TTL levels. This frequency is divided by IC512a to 5 MHz at pin 3 and to 1 MHz at pin 7. IC513 selects which of the divided frequencies is sent to the rear panel via PLAP contact 6. IC514 provides output buffering while R548 limits the current flow.

The presence of either an internal or external standard is reported on the STD SENSE line to the main processor as a status interrupt. The 1 MHz signal is buffered by TR501, smoothed by C542 and detected by IC511a. A logical high on the STD SENSE line indicates the presence of a signal but does not indicate whether it is the correct frequency. This is done later by the VCXO out of tune indicators.

Fine tuning of the internal reference (an oven controlled crystal oscillator) is achieved electronically by two separate 8-bit D-A converters in IC507 (AA1/2 sheet 5). Coarse control is provided from pin 2 via R511 and fine from pin 1 via R512. Due to the ratio of the resistors the effect of the fine control is 100 times less than that of the coarse tuning.

IC523 provides a very stable +5 V reference for the D-A converters within IC507 and IC509 (the latter is reserved for future use).

The OCXO is switched off by taking the OCXO POWER ON line high from IC510 pin 15 which turns off the +5 V power to the oscillator. This does not suppress the operation of the heater circuits as this could cause large frequency transients due to the thermal inertia of the oven as it heats and cools when the standard is switched between internal and external.

CONTROL: RF PROCESSING (AA1/2 sheet 6)

Circuit diagram: Fig. 7-7.

104.8576 MHz phase locked loop

The VCXO must be locked to the frequency standard selected by the user to guarantee its frequency stability. This is achieved by a phase locked loop (PLL) running at a reference frequency of 1 MHz (1.6 kHz for board AA1). Additional loop filtering is provided by an active 60 Hz low-pass filter which ensures the removal of the reference from the VCXO tune line. A window comparator monitors the VCXO tune line to detect when the oscillator is outside its normal operating range. The block diagram of the phase locked loop is shown in Fig. 4-2-14.

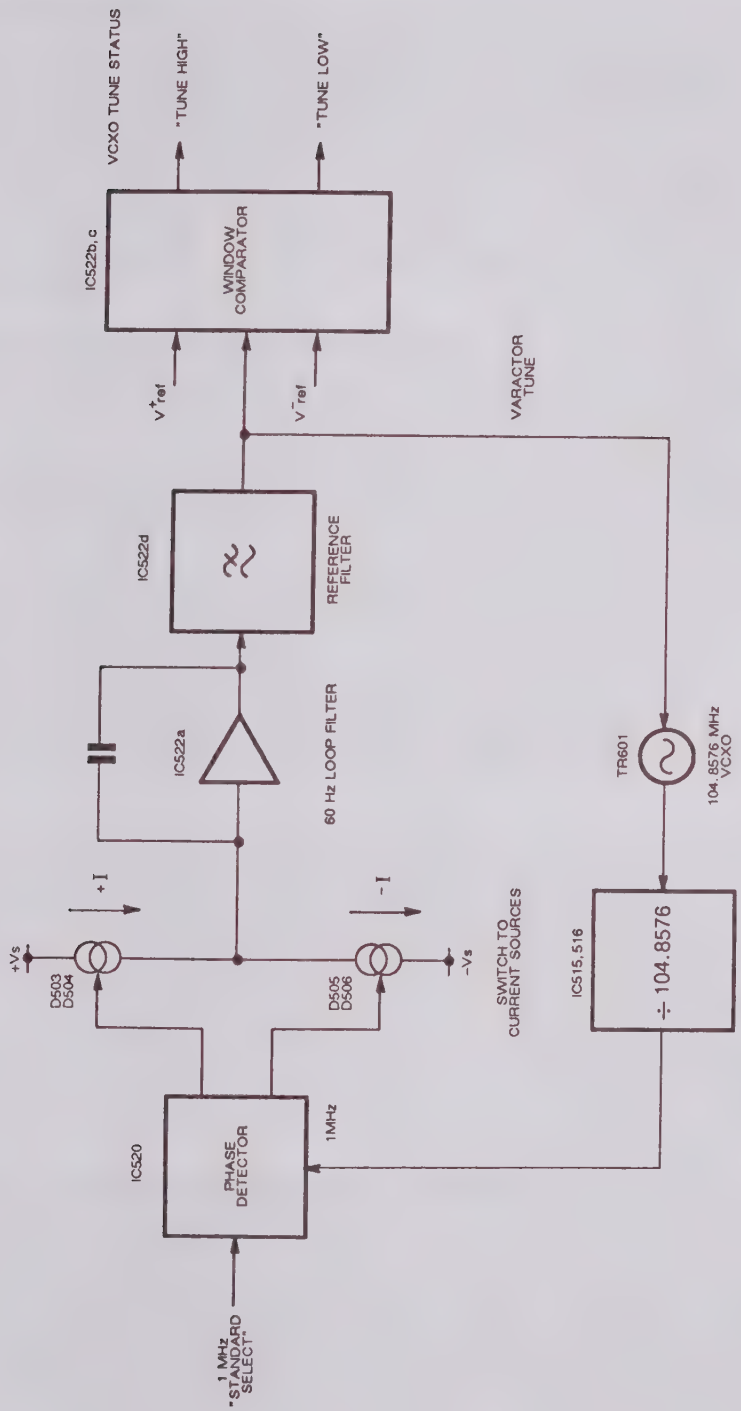

Fig. 4-2-14 104.8576 MHz phase locked loop

Loop operation

The 104.8576 MHz from the VCXO is fed to dual modulus prescaler IC515 and divider IC516. IC516 is a PLA (Programmable Logic Array) which has a controller function to enable it to set the prescaler's division ratios of either 20 or 21 when appropriate to divide the input from the VCXO by 104.8576 so as to produce a 1 MHz output at its pin 21. The divided reference frequency is fed together with the selected internal or external frequency standard to the PLL phase comparator, IC520a and b.

The reference frequency of 1 MHz, in conjunction with a narrow loop bandwidth, optimises the noise suppression and settling time of the loop. It allows the use of an active loop filter to set the narrow loop bandwidth.

Phase comparator IC520 is in a tristate dual D-type bistable configuration. IC521c generates the reset signals for the bistables at the appropriate times, while R525 and C507 extend the reset pulse to ensure that the bistables reset.

Diode bridge D503, D504, D505 and D506 sinks and sources current into loop filter IC522a depending on the drive waveforms from the phase comparator. Current is sourced into the loop filter when D503 is reverse-biased and sunk when D503 is forward-biased.

Components C512, C511 and R530 determine the main loop characteristics. The 60 Hz low-pass filter formed by R545, R533, R534, C543, C514, C550 and IC522d has some additional effects due to phase shifts within the filter response but these are minimal. D509 prevents varactor diode D601 (sheet 7) from being forward biased, while R547 (sheet 6) provides a discharge path for the varactor filter network R601 and C601 (sheet 7). R552 prevents instability by adding an additional break point at 160 kHz well outside the operating loop bandwidth.

IC522b and c form a window comparator which detects when the VCXO tuning voltage is exceeded. The outputs from detectors D507 and D508 on the VCXO TUNE HIGH & LOW lines are attenuated to logic levels by R538, R539 and R540, R541 to provide status interrupts to the main processor via IC414 (sheet 4) and IC108 and IC110 (sheet 1).

Loop operation (AA1 sheet 6)

Circuit diagram: Fig. 7-8.

PLL operation is similar to that described above for board AA1/2 except for the following significant differences.

The 104.8576 MHz from the VCXO is divided by IC515 to IC518 to the reference frequency of 1.6 kHz (a division of 65536). Similarly the selected frequency standard is divided by IC517 and IC518 to the same reference frequency (a division of 625). IC519a and IC520a provide edge re-timing before the signal is fed to the PLL phase comparator. Phase comparator IC519b and IC520b is in a tristate dual D-type bistable configuration. IC521c generates the reset signals for the bistables at the appropriate times, while R525 and C507 extend the reset pulse to ensure that the bistables reset.

The PLL BOOT line from pin 12 of IC510 is used to reset the initial starting phase of the counters at switch on and when changing between standards. When this line is pulsed high it resets the counters to zero returning the accumulated phase error to a small amount for a faster lock-in time.

CONTROL: 104.8576 MHz VCXO & 62.5 DIVIDER (AA1/2 sheet 7)

Circuit diagram: Fig. 7-9.

The 104.8576 MHz VCXO is used to derive all of the clock signals necessary to drive the ASICs (Application Specific Integrated Circuits) on the control board. Using a high operating frequency eliminates the need for a second phase locked oscillator to generate the necessary local oscillator frequency for BFO board AB4/1. The 62.5 divider provides the 1.6777216 MHz drive signals for the RF synthesizer, the FM A-D converter and the audio synthesizer.

VCXO Operation

The 104.8576 MHz oscillator is built around TR601. Crystal XL601 together with L601 and D601 provide a series resonant circuit in the emitter circuit of TR601. At resonance it increases the gain of the common emitter stage and together with 180 degree phase shift network L604, C603, C604 and L602 connected between the base and collector of TR601 provides the necessary conditions for oscillation. L603 tunes out the parasitic capacitance of the crystal package and prevents other spurious oscillations from occurring.

A facility to fine tune the phase shift network is provided by C604. At the resonant frequency the circuit operates at maximum power levels when the correct phase shift is achieved around the transistor.

TR602 buffers the signal. Local oscillator drive (at typically +6 dBm) to the BFO is derived from the collector, and a suitable drive level for limiter/level translator TR603 and TR604 from the emitter.

Divider operation

The 1.6777216 MHz clock signal is produced by dividing the 104.8576 MHz output from the VCXO by 62.5. This is done by the fractional divider formed by ICs 601 to 604 and IC617. Dual modulus prescaler IC601 is controlled by the gates of IC602 and IC604 so that it divides by either 10 or 11 at the appropriate phases. It divides in the sequence 10,10,11,10,10,11 for 62 cycles, and 10,10,11,10,11,11 for 63 cycles. A period of 6 cycles is counted by the divide-by-6 section of IC603, and alternate 62 and 63 cycles are counted by the divide-by-2 section.

CONTROL: CARRIER FREQUENCY SYNTHESIS (AA1/2 sheet 7)

Circuit diagram: Fig. 7-9.

The RF carrier of the instrument should be as clean in frequency (and level) as possible. To achieve this goal the instrument relies on a single loop synthesizer scheme based on four UHF oscillators covering the fundamental range from 675 to 1350 MHz. Utilising such high frequencies minimises the RF processing circuitry normally associated with conventional frequency doubling or mixing schemes. Four UHF oscillators (in quarter octave bands) are used for good FM linearity.

A carrier frequency resolution of 0.1 Hz cannot be achieved easily without the use of non-integer division. In this instrument this operation is controlled by a dedicated ASIC which

modifies the division ratio of a programmable divider so that the average frequency is a non-integer division of the input.

The RF carrier can operate in one of three modes of operation which effects the instantaneous frequency. These are CW, FM/ΦM and SWEEP. Each mode puts different requirements on the loop characteristics which must be modified accordingly to suit.

The sweep mode forces rapid re-programming of the controller IC providing discrete steps in the carrier frequency and is therefore not truly continuous. The block diagram of the synthesizer is shown in Fig. 4-2-15.

Note...

The synthesizer is split over the three boards AA1/2, AB1 and AB2/2 to provide signal isolation and ease of maintenance.

Synthesizer operation

Frequency synthesis control is performed by a dedicated ASIC, IC614. This generates all of the necessary signal division ratios for the ECL counter chain formed by IC608 to IC612 to eventually synthesize any frequency within the range of just over 675 to 1350 MHz.

The incoming signal on the 1350-675 MHz RF SYNC line from the main VCOs on AB1 is buffered by TR615 to prevent divider backfire (from IC613) onto the VCO board which could otherwise be superimposed on the eventual RF carrier. TR616 and associated circuitry provide active bias for TR615 to ensure correct operation over the whole temperature range of the instrument.

The incoming signal is first pre-scaled by divide-by-four divider IC613 to bring the frequency down to the operating range of the programmable divider. IC612 is a dual modulus divider (divide by 8/9) which together with the programmable divider (IC608 to IC611) provides an integer division ratio in the range from 100 to 202. This ratio ensures that the ASIC always receives an acceptable clock frequency to work from. Fractional division is achieved by the modification of the integer division ratios, under the control of the ASIC, in such a way that the average frequency over time is not an integer division ratio of the original. The divider is made from ECL components due to the required speed of operation.

TTL to ECL conversion is provided by a resistor network. Resistor packages R684 and R685 set up the initial DC offset condition which is then modified by IC614 through R692 to R699 and R701 to R708. The impedance of the network is such that the 5 V from the ASIC is not seen by the ECL counters. ECL to TTL voltage translation is performed by TR611 to TR614. This cannot be done by a passive network since voltage swing needs to be increased.

The divided frequency is compared with a reference frequency of 1.6777216 MHz, derived from the 104.8576 MHz on-board VCXO, by four-state phase comparator IC605b, IC606 and IC607a which has the property of being extremely linear with minimal dead zone. This prevents the loop from 'hunting' within the lock range of the PLL.

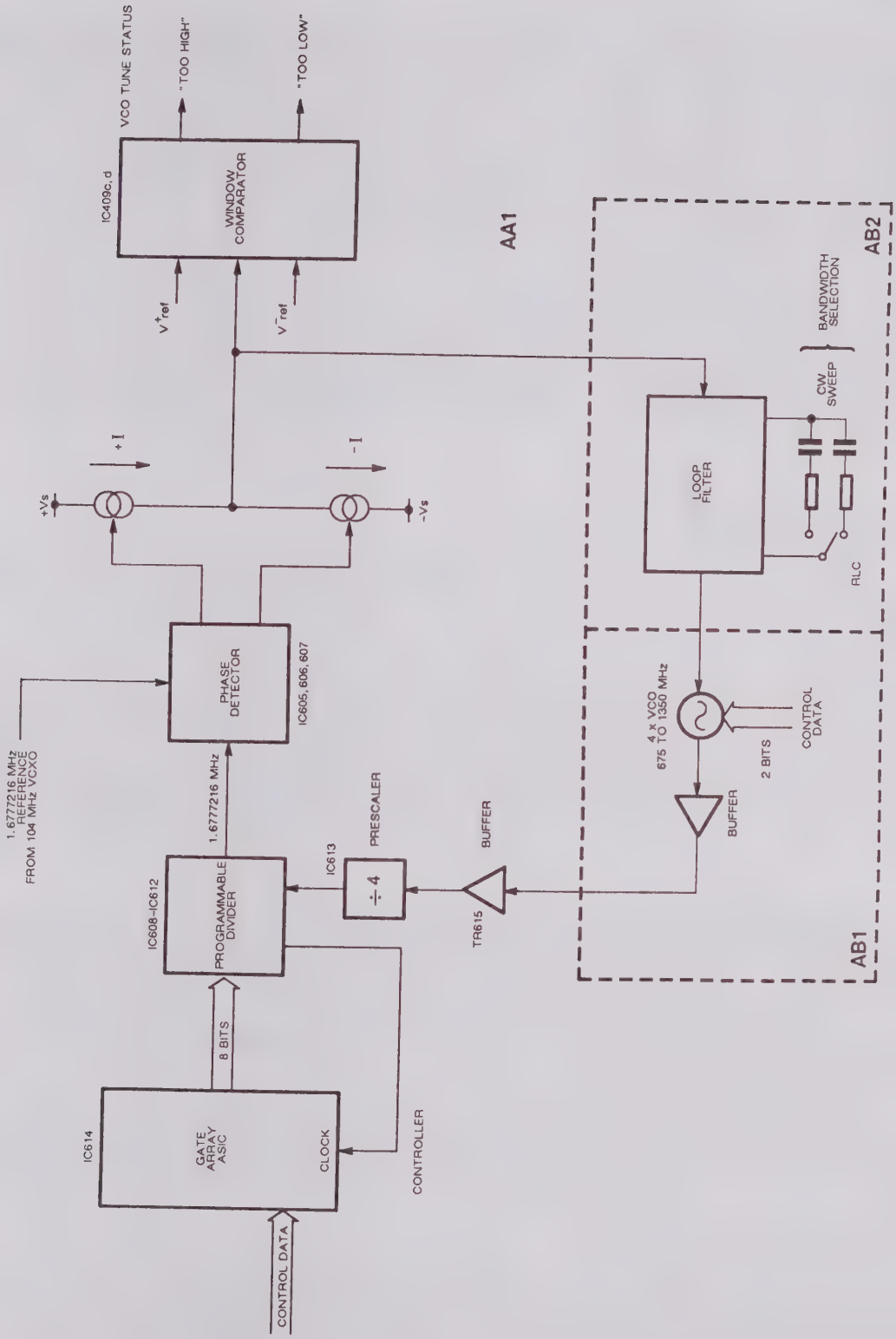

Fig. 4-2-15 Carrier frequency synthesizer

The output waveforms are voltage translated by TR605 to TR610 and filtered by C615 and L605 plus C420 (sheet 4) and C616 and L606 plus C421 before being converted to current to drive into the loop filter by TR401 and TR402. TR403 to TR406 modify the current transfer function of the voltage to current converter which together with a change in the integration capacitor (C31 and C32 on AB2/2) provides the necessary changes to the loop characteristics for the three operating modes of the carrier. (For RF loop filters see under 'VCO drive, loop filter & FM' below.) Output is on the VCO TUNE line to AB2/2.

The main PLL is continuously monitored by IC409c and d (TR408 is reserved for future use) which detects when the varactor tune range is exceeded. D407, D406 and R456 prevent the varactor from being forward biased when the loop loses lock temporarily during changes in the requested frequency. The detected outputs from D405 and D408 on the VCO TUNE HIGH & LOW lines are attenuated to logic levels by R454, R455 and R457. From IC414 they cause a status interrupt to the main processor on the VCO OUT OF LOCK line via IC108 and IC110 (sheet 1).

1-bit A-D converter

The DC input path to the synthesizer consists of a third order, single bit, oversampling A-D converter, whose bit stream output is used to dynamically control the synthesizer frequency via the synthesizer ASIC.

Pin 6 of IC615b is used as the summing junction for four currents. These are: the input current via R671; a bipolar offset current via R670; the bit stream feedback via R674; and the DC nulling offset current via R672. IC615b integrates the sum of these currents, and its output is further integrated by broken integrators IC615c and d. In these, when the frequency rises to a point where C629 and C630 are at low impedance, the ICs act as unity-gain amplifiers. Diodes D605 and D606, D613 and D614 are used to enable the converter to recover from overload cleanly.

The output from the last integrator is fed via comparator TR617, which converts the input to TTL levels, to D-latch IC616a, which is clocked at the same rate as the synthesizer ASIC. NOR-gate IC618a is used to produce a uniform length output pulse from the D-latch, this is fed back into the summing junction to close the converter control loop. The digital input to IC614 pin 54 is a bit stream whose logic levels are determined by the state of the output from IC618a at the instant that the ASIC is clocked.

The DC nulling offset current is supplied from a 1-bit oversampling D-A converter in the synthesizer ASIC. This balances the input current to make the converter read zero when DC nulling and when in AC coupled FM mode.

Board AA1 differences

The converter for board AA1 is similar to that for board AA1/2 except for the loop D-A reconversion process. Pull-up resistor R687 and pull-down resistor R678 together with D611, D612 and R675 convert the 0 to 4 V bit stream input to ±2 V prior to feeding it to the D-A converter. This is formed from D607 to D610 with R674 and R676. The bit stream input biases the diodes so that current is sourced and sunk to and from C627 to provide the required analogue feedback.

VCO BOARD - AB1

Circuit diagram: Fig. 7-10.

Four oscillators are used to cover the basic frequency range, each VCO covering one quarter octave. Selection of the oscillators is carried out by IC1 and switches TR5 to TR8. These switch the oscillator currents allowing only one to operate at any one time. Binary decoder IC1 is controlled by the two control lines FC1 and FC2 from AB2/2 (see Table 4-2-7 below).

TABLE 4-2-7 IC1 VCO SELECTION LOGIC - AB1

FC2	FC1	VCO selected	Frequency range (MHz)
0	0	0	675 to 803
0	1	1	803 to 955
1	0	2	955 to 1135
1	1	3	1135 to 1350

Each VCO operates in a similar manner, with the tuning voltage from the VARACTOR TUNE line on AB2/2 varying the four varactor diodes, D1 to D4, in parallel. The nominal range for all four oscillators is 3 V to 13 V giving the required FM linearity. Taking VCO 0 as an example, the lowest quarter octave is generated by the tuned circuit formed by D1 and C4 and the two inductors formed by lengths of PCB track. The necessary positive feedback is provided by TR1 whose base is driven from a tap on one inductor and whose collector is connected via R8 and C5 to the other inductor. The damped emitter decoupling is arranged to give correct flat oscillation over the required range.

Pairs of oscillators VCO0, VCO1 and VCO2, VCO3 are connected via quarter wavelength lines to ensure that one oscillator does not load the other. The two half octaves are combined by D5 whose control current is sourced either from D6 for the lower half octave or from D7 for the upper half. This operation is controlled by IC1.

The selected signal is buffered by IC2 and then split into three parallel paths which are further buffered by ICs 3 to 5. One output is routed to the RF board AB2/2 RF INPUT line while the second is routed to the synthesizer on AA1/2 on its 1350 - 675 MHz RF SYNC line. The third output is not used.

RF BOARD - AB2/2

Circuit diagrams: Figs. 7-11 to 7-15.

This board processes the signal from the VCOs on board AB1. The signal is divided to the required frequency, then filtered and amplified. The amplified signal is detected and then level corrected by the ALC to provide the correct voltage behind a 50 Ω sourcing resistor. All input to the RF deck comes via PLBK and PLBJ from board AA1/2. AB2/2 routes control and power to the other boards on the RF deck, AB1, AB3/1 and AB4/1.

RF BOARD: DIVIDERS AND FM DRIVE (AB2/2 sheet 1)

Circuit diagram: Fig. 7-11.

Decoding

Two latches control operation of the RF deck while a shift register is used to read RF board status information back to the processor.

IC7 latches the frequency word used by the VCOs, divider and filters using BD7 to BD3. BD7 and BD6 are used to select the VCO to be used (see Table 4-2-8 below), and BD5 to BD3 select the division ratio (see Table 4-2-9 below). BD6 to BD3 are also used to select the required low-pass filter. IC7 uses the LOOP SWITCHING lines to select the ALC mode (see Table 4-2-10 below).

TABLE 4-2-8 IC7 VCO SELECTION LOGIC - AB2/2

BD7	BD6	VCO frequency
0	0	675 - 803 MHz
0	1	803 - 955 MHz
1	0	955 - 1135 MHz
1	1	1135 - 1350 MHz

IC9 latches selection data for AB3/4 or AB3/5 using BD1 to BD5. BD7 supplies the logic for the AB3 DETECTOR line to relay RLB which is used to select the required detector from AB2/2, AB3/4 or AB3/5. BD0 supplies the logic for the SWEEP BANDWIDTH CONTROL line to RLC which is used to select the appropriate filter path for the VCO tuning voltage.

TABLE 4-2-9 IC7 VCO DIVISION LOGIC - AB2/2

D5	BD4	BD3	Division ratio
1	1	1	No division
0	0	0	2
1	0	0	4
0	1	0	8
1	1	0	16
0	0	1	32

TABLE 4-2-10 ALC MODE LOGIC - AB2/2

BD2	BD1	ALC mode
0	0	Normal ALC
0	1	Levelling phase
1	0	Frozen loop
1	1	Pulse enabled

Shift register IC8 is used to report the board status on the RF STATUS line to the Readback Status Buffer on AA1/2. PULSE MOD SENSE checks for the presence of the pulse modulator option. When the option is fitted, the status line is pulled high by a pull-up resistor. When not fitted, a 1.8 dB pad is inserted in its place and the line is earthed. BOARD SENSE is used to check that the board +5 V logic supply is present. ALC STATUS, used in pulse levelling phase mode only, reports ALC high or low and is supplied by IC10 (sheet 2).

Dividers and straight-through path

For frequencies above 675 MHz the signal on the RF INPUT line from AB1 is routed directly through diodes D2 to D5. This route is selected by switching off TR10 thereby reverse biasing D1 and D11 so that the divider and level restoring amplifier are switched out of circuit. Bias, supplied by IC1a, is also removed from IC2 to prevent it from oscillating.

For frequencies below 675 MHz TR10 is switched on, diodes D2 to D5 are reverse biased, and the signal is routed to programmable divider IC2. Control bits FC3 to FC5 from IC7 determine whether a division ratio of 2, 4, 8, 16 or 32 (see Table 4-2-9) is selected by IC2. Levelling amplifier TR1 compensates for the slope of the divider frequency response, restoring the signal to a nominal 0 dBm.

VCO drive, loop filter & FM

The VARACTOR TUNE line to VCO board AB1 is controlled by the VCO TUNE line from AA1/2. During CW operation the tuning voltage is fed in via RLC contacts 6 and 3 with the loop filter provided by R31 and C32. For sweep operation the SWEEP BANDWIDTH CONTROL line from IC9 is taken high which switches on driver TR12. This energises RLC which causes the tuning voltage to be routed via contacts 5 and 4, with the loop filter now provided by R96, C85, C86 and R95.

For FM the audio drive is fed in on the FM line from AA1/2 via RLA contacts 5 and 4. If the signal is to be attenuated, the 48dB PAD line is taken low to energise RLA which then selects the route via contacts 6 and 3 and the pad formed by R34, C88, R35 and R36. For FM operation the BW CONTROL line is also taken high which switches on FET TR2. This modifies the CW filter and applies the modulating signal via C31 to the VARACTOR TUNE line.

Driver TR13, relays RLD and RLE and the associated IF VCO TUNE and LOCK lines perform no function in the 2030 series signal generators (note that these components do not appear on the AB2 board). The circuit diagram shows the contacts of these relays in their normal, unused, positions.

RF BOARD: MODULATOR AND DECODING (AB2/2 sheet 2)

Circuit diagram: Fig. 7-12.

Amplitude modulator

The amplitude modulator acts both as the variable gain element of the ALC and to provide the amplitude modulation of the carrier. It comprises two similar RF attenuators R21

with R23 and R26 with R28 each followed by a buffer, IC6 and IC100 (sheet 3). High-pass filter C21, L7 and C22 removes audio. Modulator drive is described below.

Automatic level control (ALC)

Two distinct methods of level control are used. For normal operation an ALC circuit is used. However, for pulse modulation, the ALC loop is broken and the drive level is frozen.

With ALC the output level is detected by positive- and negative-peak detectors and compared with a reference signal (which includes any AM required). The error is integrated to provide a current drive for the amplitude modulator.

For pulse modulation, the ALC error output is mimicked by a D-A converter driven voltage source. This is then used to provide current drive into the amplitude modulator.

ALC operation

For signals up to 1350 MHz the ALC REF input from AA1/2, comprising DC plus AM, is low-pass filtered by L21 and C99 and fed to non-inverting amplifier IC3a. The signal is then AC-coupled by C40 (after inversion by IC3b) to the positive peak detector path, and by C39 to the negative peak detector path. At these points the positive and negative detected outputs from the output amplifier are fed in via D306 (sheet 4). The signals then provide offsets against the positive and negative voltages produced by R49 with R50, and R52 with R53 respectively. Temperature compensation is provided by D305 which produces an offset to the negative voltage produced by R59 and R60 which is then applied to the non-inverting input of IC3d. IC3d and IC4a are output buffers which respectively feed out the negative and positive peak detected signals. When selected by RLB these signals are summed with the ALC REF signal from the input by integrator IC5c. If the result of the summation is not zero pin 8 will ramp up or down charging or discharging C41 until level is correct.

For operation above 1350 MHz where either the frequency doubler or frequency quadrupler board is involved, RLB breaks the ALC loop and the inputs to be summed by IC5c are ALC REF from AA1/2, and COMP DIODE and -DET from the levelling detector on either AB3/5 or AB3/4. Since these inputs are from a single (negative) detector, summing resistors R81 and R82 are half the value of the Detector Summing resistors R54 and R62.

Output from the integrator is then used to provide a current input to the Modulator Drive circuit.

Modulator drive

There are two modes of operation, normal and pulsed.

Normal operation

During normal operation, i.e. pulse modulation is not enabled, the error voltage to integrator IC5c controls the voltage to IC5d. IC5d and TR6 act as a voltage to current converter which controls the attenuation of the Amplitude Modulator diodes and hence the signal level of the RF chain. The voltage to current converter has a standing current drawn through R71 to allow charge to be drawn quickly from the modulator diodes to ensure deep amplitude

modulation performance. Also during normal operation, the OPEN LOOP REF line is held at earth potential to prevent false triggering of ALC status comparator IC10.

Pulse operation

For pulse modulation the above levelling system cannot be used since the integrator output would be uncontrolled when the RF was switched off by the pulse. To overcome this the integrator output is replaced by a DC voltage.

Whenever pulse mode is selected, or when in pulse mode the ALC REF is changed, the instrument goes through a levelling phase in which the voltage on the OPEN LOOP REF line is set so that the output from IC5b is the same as the output from integrator IC5c. The modulator drive is then switched from the integrator to the OPEN LOOP REF line which now holds the frozen ALC reference, and pulse modulation can be enabled.

For pulse mode the standing current to TR6 is not required so R71 is switched out of circuit. The voltage on the OPEN LOOP REF line is scaled and referenced to the +15 V rail by IC5a and TR4. This ensures that the output from voltage follower IC5b will track any fluctuations in the +15 V rail.

The levelling phase consists of removing R71 using switch IC11d and then adjusting the open loop reference D-A converter on AA1/2. A successive approximation process is used in which the output from IC5b is continually monitored until it is the same as the output from IC5c. Monitoring is by comparator IC10; any detected output from D19 on the ALC STATUS line is attenuated to logic levels by R48 and R51 and sent by IC8 (sheet 1) as part of the status word. Once both outputs are the same, the input to IC5d is switched from the integrator to the OPEN LOOP REF line.

Since the current drive is required to vary over a wide dynamic range, the open loop reference scaling has a range switch TR5 which has a ratio of 5:1. It ensures that the resolution of the 12-bit D-A converter on AA1/2 maintains the output level in pulse mode accurately over the full range of the instrument. The power range is selected during the successive approximation routine. To increase the range the OPEN LOOP POWER RANGE line is taken high which switches on TR5 to connect R72 in parallel with R73.

Loop switching

Selection logic (see Table 4-2-10) for control lines LOOP SWITCHING A and LOOP SWITCHING B is supplied by latch IC7 (sheet 1). The logic controls four switching diodes D22 to D25 and four inverting switches forming IC11, with IC11c ensuring that IC11b operates in the opposite manner to IC11a. In normal operation both lines are low, IC11a is switched on, and the integrator supplies the modulator drive. Only in this mode are both diodes D22 and D23 reverse biased enabling R71 to be in circuit. In levelling mode the LOOP SWITCHING B line is taken high which causes IC11d to switch on to remove R71. For pulse mode but with pulse modulation off, LOOP SWITCHING A is taken high with LOOP SWITCHING B low and the output level is determined by the OPEN LOOP REF line. For pulse modulation both LOOP SWITCHING lines are taken high which reverse biases D24 and D25 allowing pull-up resistor R66 to take the PULSE ENABLE line high to open the gate to the PULSE MOD INPUT line (sheet 4).

TR401, controlling the ALC SLUG line, and associated components perform no function in the 2030 series signal generators (these components do not appear on the AB2 and AB2/1 boards).

RF BOARD: HARMONIC FILTERS (AB2/2 sheet 3)

Circuit diagram: Fig. 7-13.

These filters are arranged in three banks. Each bank has four low-pass filters set at half octave intervals. They are selected by diode switches so that any filter in the selected bank with cut-off above the desired frequency is switched in and the remainder bypassed.

Operation

Filter selection is controlled by decoders IC101 and IC102 which decode the FC2 to FC5 and FC5(L) lines from IC7 (sheet 1). The low-pass filters are arranged in three banks, with the bank and filter being selected by the decoders taking the appropriate line low. This forward biases the selection diodes for one bank while taking the other lines high to reverse bias the remaining selection diodes. When for example, IC102 pin 9 is taken low it forward biases D100, D140 and D141 at the input and D110, D142 and D143 at the output and the low-pass filter selected is the 1350 MHz printed filter. If instead, IC101 pin 6 is taken low to select the 169 MHz filter, input diodes D113 and D144 at the input and D123, D145 and D146 at the output are forward biased so that the 239 MHz and 169 MHz filters are enabled. Pull-up resistors R111 to R113 ensure that each filter bank is securely shut off when not required.

RF BOARD: PULSE MOD AND O/P AMP (AB2/2 sheet 4)

Circuit diagram: Fig. 7-14.

Pulse modulator option

The pulse modulator receives a digital modulating signal from PLBP on the PULSE MOD I/P line. The signal is high-pass filtered by C309, L301, C308, L300 and C307, limited by D302 and D303 and squared by Schmitt gates IC300a and c. When PULSE ENABLE is taken high by the Modulator Drive circuit (sheet 2) it opens gate IC300c allowing IC302 to be switched by the modulating signal. IC302 is configured as a 2-channel switch which alternately switches between its channel 0 and channel 1 inputs. When pin 10 is taken low, channel 0 inputs are selected and output pins 3 and 13 are taken high and low respectively. And when pin 10 is taken high, channel 1 inputs are selected and the output logic levels are reversed. These outputs control pulse modulator IC301 (fitted in place of the 1.8 dB pad).

Output amplifier

This is a three stage wide-band amplifier based on TR311, TR313 and TR315 with TR310, TR312 and TR314 respectively controlling the bias. The latter sense the collector currents through R326, R337 and R349. 20 dB of gain is provided to a maximum of +19 dBm after a 50 Ω sourcing resistor. Output level is positive- and negative-peak detected by D306 with a dummy detector giving a thermal reference.

Switched attenuator driver

Attenuator IC401 and associated components perform no function in the 2030 series signal generators (these components do not appear on the AB2 and AB2/1 boards).

Pulse modulator option (AB2 sheet 4)

Circuit diagram: Fig. 7-15.

Pulse modulator operation is similar to the above except that when PULSE ENABLE is taken high by the Modulator Drive circuit (sheet 2) it opens gate IC300b allowing TR302 to be switched by the modulating signal. TR302 then drives complementary switching transistors TR300 and TR301 controlling pulse modulator IC301 (fitted in place of the 1.8 dB pad). On board AB2/1, TR300 and TR301 are replaced by IC302c and d.

BFO SWITCH AND RPP BOARD - AB3/1

Circuit diagram: Fig. 7-16.

Board AB3/1 is used for the 2030 instrument in place of Doubler AB3/5 or Quadrupler AB3/4. Its purpose is the selection of either Beat Frequency Oscillator board AB4/1 or a straight through path to the output attenuators.

Signal routeing

Signal routeing is carried out by two relays RLA and RLB. The relays operate in conjunction with, and are controlled by, the BFO line from AB2/2. With the relay solenoids unenergized the RF INPUT line from AB2/2 is connected directly to the RF OUTPUT line. But when the BFO line is taken low, TR1 switches on. This causes RLA to connect the RF INPUT line to the BFO OUTPUT line to AB4/1 while simultaneously RLB connects the BFO INPUT line from AB4/1 via low-pass filter C10, L3 and C11 to the RF OUTPUT line.

Reverse power protection

Signal level on the RF OUTPUT line is monitored by a reverse power protection circuit. This has both positive and negative arms with the stand-off voltages set by Zener diodes D3 and D2 respectively. When the output voltage swing rises sufficiently to cause either D4 or D5 to be forward biased it conducts and so limits that voltage peak.

HIGH POWER AMPLIFIER BOARD AB3/3

Circuit diagram: Fig. 7-17.

This board is an option (Option 003) used to provide an RF signal output at a level of up to +19 dBm across the frequency range 10 kHz to 1.35 GHz. Board AB3/3 is used only in the 2030 instrument where it replaces BFO switch and RPP board AB3/1.

The overall operation of the board is to amplify the RF signal from AB2/2 and direct it either straight to the output attenuator for the range 21.09375 to 1350 MHz, or to BFO board AB4/1 for the range 10 kHz to 21.09375 MHz.

Attenuator and amplifier

The signal from AB2/2 on the RF INPUT line is first of all fed to a pin diode attenuator based on D6 which varies the overall gain of the board. Bias is controlled by TR3 driven by attenuator driver IC2c and d whose output is a DC offset added to the ALC reference. The purpose of this is to maintain the RF signal at a high level on RF board AB2/2 when lower output levels are required. This is accomplished by increasing the attenuation at low ALC requests and thus reducing the overall gain of the board. Consistent high levels on board AB2/2 help to maintain the noise performance of the instrument and the dynamic range of the modulator.

The high power amplifier which follows has a typical gain of 10 dB and consists of two stages; a medium power driver stage based around TR5 and a high power output stage based around TR7. Both stages employ resistive feedback and have active bias controlled by TR4 on the driver stage and TR6 on the output stage. The active bias circuits sense the collector currents in the transistors and guarantee the stability of their operating points with temperature.

Levelling detector

Board AB3/3 provides all the RF levelling for the signal generator and overrides the detector on board AB2/2. Levelling is accomplished by having negative detectors (D8 and D9) each side of a 25.5 Ω sourcing resistance (R58 and R27). The detected levels are then controlled using IC1 and its associated components. This makes the detected voltage at pin 8 of IC1c the same level as is it were the voltage obtained from a single negative detector behind a 50 Ω sourcing resistor. This voltage is then fed back to the ALC on board AB2/2 through R4 which forms part of a summing junction on AB2/2. Temperature compensation for the detector diodes is also fed back to the ALC on AB2/2. The compensation is provided by D10 and IC2b.

When the instrument is generating AM the detector is aided by AM bootstrap IC2a which uses the AM request on the ALC REF line to drive the detected voltages at pin 3 of IC1a and at pin 5 of IC1b.

Signal routeing

Signal routing is carried out by two relays, RLB and RLC. These select the path to either the output attenuators or BFO board AB4/1. To select the BFO route the BFO SELECT line from AB2/2 is taken low which switches on driver TR1 to energize the relays. This connects the signal from the levelling detector to the BFO BAND RF OUTPUT line to AB4/1, and from

AB4/1 on the BFO BAND LF INPUT line via low-pass filter C7, L7 and C8 to the output attenuators on AT1.

Reverse power protection

Signal level on the RF output line is monitored by a reverse power protection (RPP) circuit. This has both positive and negative arms with the stand-off voltages set by Zener diodes D2 and D1 respectively. When the RF level rises sufficiently to cause either D4 or D5 to be forward biased it conducts and so limits that voltage peak.

QUADRUPLER BOARD - AB3/4

Circuit diagrams: Figs. 7-18 to 7-21.

Board AB3/4 is used for the 2032 instrument in place of AB3/1 for the 2030, or AB3/5 for the 2031. The purpose of the quadrupler board is to take the top octave from RF board AB2/2 in the range 675 to 1350 MHz and double it to produce an output at 1350 to 2700 MHz, or double it again to produce a quadrupled output at 2700 to 5400 MHz. When the doubler/quadrupler path is selected, the signal is applied to the first doubler which produces the desired doubled signal at 2f plus unwanted harmonics. The doubler output is then amplified, amplitude modulated, amplified again and then passed through one of three band pass filters (BPF), at between 1.35 and 2.7 GHz. A much cleaner 2f signal is then switched either to go through the second doubler stage or to bypass it and go directly to the output stages. Note that for these higher frequencies this board supplies modulation in addition to that provided by RF board AB2/2.

If signal quadrupling is selected the signal is amplified and fed into the second doubler. The doubler output, as before, is rich in harmonics and is therefore amplified and passed through the second set of BPF, between 2.7 and 5.4 GHz. The doubler/quadrupler outputs are then combined, power amplified, switched and passed through a 5.5 GHz low-pass filter. The output is finally passed through step attenuator AT10 and then to the output connector. The output stages also incorporate level detection circuitry and reverse power protection (RPP) of up to 50 W.

A secondary function, for frequencies from 10 kHz to 21.09375 MHz, is the selection of the path to BFO board AB4/1. For frequencies from 21.09375 to 1350 MHz the doubler/quadrupler path is bypassed. Fig. 4-2-16 summarises board AB3/4 operation where it can be seen that the physical layout of the board is divided into four areas which are screened to reduce subharmonic levels. These areas are numbered in sequence to the RF signal flow.

Signal routeing

RF signal routeing is carried out by four relays, RLA and RLB in board area 1 and RLC and RLD in board area 4. The two outer relays RLA and RLD select either the straight through or the frequency doubler/quadrupler path. Relays RLB and RLC are used to switch in/out the BFO (Beat Frequency Oscillator). Dual relays are used for RLB in the input and RLC at the output in order to achieve sufficient isolation in the unwanted signal path. The relays are controlled by TR101 and TR104. To select the straight through, unmultiplied, route the relays connect the RF input from AB2/2 via a 1.38 GHz low-pass filter directly to the output. To select the BFO route the BFO SELECT line from AB2/2 is taken low which switches on BFO driver

TR104 to energize relays RLB and RLC. IC101a pin 7 is also taken low which switches on TR102 to energize RLD. This connects the RF input line to AB4/1, and then from AB4/1 via low-pass filter C432, L401 and C433 to the output. To select the frequency multiplied route decoder IC101 switches driver TR103 off and driver TR102 on which control RLA and RLD. Relay operation is summarized in Table 4-2-11.

TABLE 4-2-11 RELAY CONTACTS MADE - AB3/4

Selection	RLA	RLB	RLC	RLD
Straight through	7-5	1-3 7-5	7-5 1-3	8-7*
Doubler	7-6*	7-6 * 1-2	7-6 * 1-2	8-6
Quadrupler	7-6*	7-6 * 1-2	7-6 * 1-2	8-6
BFO band	7-5	7-6 1-2	1-2 7-6	8-7*

* energized position

QUADRUPLER: FIRST DOUBLER & MODULATOR (AB3/4 sheet 1)

Circuit diagram: Fig. 7-18.

The frequency doubler/quadrupler path is selected by relays RLA and RLD which are controlled by decoder IC101a. When IC101a pin 7 is taken high, complementary solenoid drivers TR102 and TR103 are switched off and on respectively. Relay contacts are then as shown in Table 4-2-11 above and the signal from AB2/2 enters via the 1.38 GHz low-pass filter to the doubler/quadrupler and then out to step attenuator AT10. The incoming signal is fed in via transformer T101 which provides a balanced signal for the following frequency doubler. Frequency doubling is achieved by full-wave rectification by diode bridge D103. To increase conversion efficiency the diode bridge is biased to bring the operating point closer to the 'knee' and this is provided by the temperature compensated DC bias network of D102 and IC102a. A fixed current is passed through D102 (which is physically close to D103) and the corresponding voltage across it is measured by IC102a. Small value resistor R113 is placed in series with D102 to allow for small variations in diode current so as to compensate for small differences in temperature coefficient between D102 and D103. The resulting voltage is applied to D103 bridge via a quarter-wave stub which provides high impedance to RF signals. The quarter-wave stub isolation technique is used extensively in other parts of the circuitry for applying DC biasing.

The doubled signal is then fed into the recovery amplifier based around TR105. Transistor TR105 has active DC biasing provided by IC102b. The potential divider network of resistors R124 and R125 sets the voltage on pin 5 of IC102b to 0.59 V, which in turn controls the emitter voltage of TR105 via R122. Assuming initially TR105 is switched off, the voltage on pin 6 will be 0 V, causing IC102b output to go high and thereby switch TR105 on. At equilibrium IC102b pin 6 voltage is also at 0.59 V which in turn sets TR105 emitter voltage to 0.59 V and current to 35 mA. Resistor R118 and C106 network has the effect of flattening the frequency response.

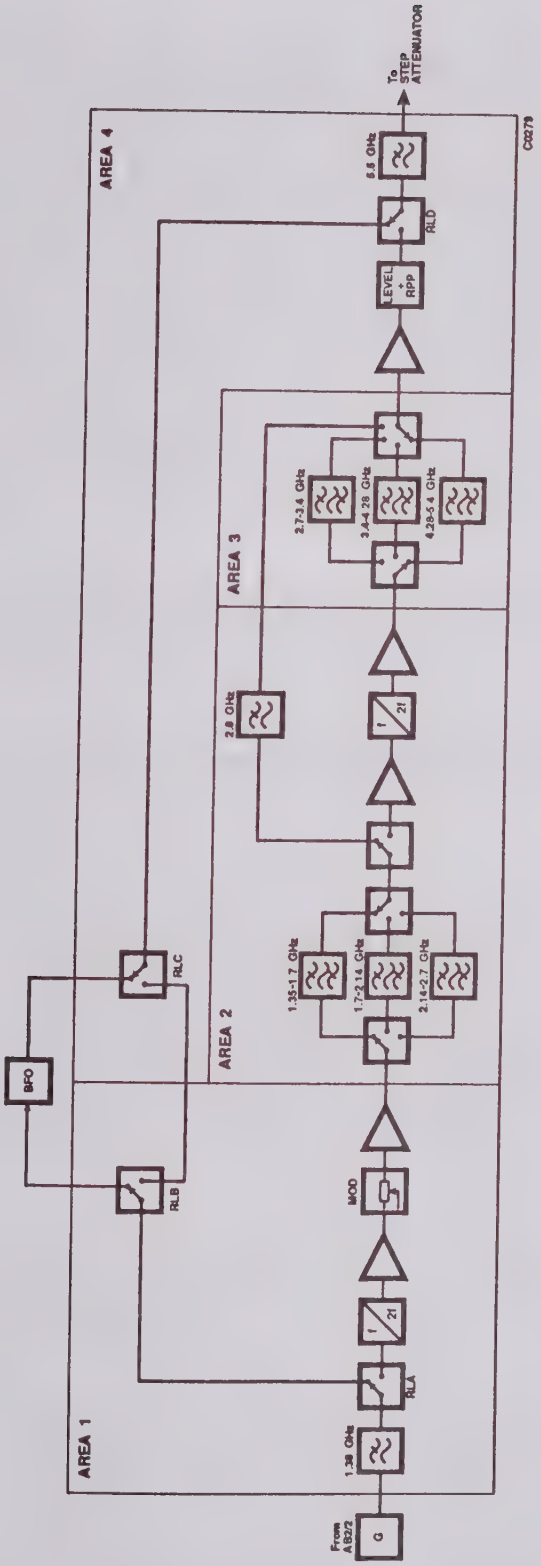

Fig. 4-2-16 Quadrupler board operating summary - AB3/4

The amplified output is then amplitude modulated by diodes D105 and D106 which are biased to the 'knee' points by the R126 and R127 combination. The modulating currents return to earth via D107 and R129; the series R128 and diode network biases the D107 series diode to its knee point. Modulation drive is applied to IC102d, with offset generated by the R132 and R133 network, followed by the class-AB power amplifier formed by TR108 and TR109. The output is then applied to modulating diodes D105 and D106. Whenever the doubler/quadrupler path is selected, IC101a pin 7 goes high switching TR101 on which has the effect of attenuating the high frequency signals to earth; R102, R103 and C101 act as a lead-lag network. Similarly, when low noise mode is selected transistor TR107 is switched on, which reduces the amplitude modulation bandwidth (and modulator noise) by attenuating higher frequencies to earth via the R130, C120 and C121 network. The modulated signal is then further amplified by TR106 and TR111. Transistor TR106 has a similar biasing arrangement to TR105. Transistor TR111 is biased by the current source arrangement based on TR110. Resistors R150 and R151 set the TR110 base voltage, which in turn sets the emitter voltage to 11 V. The current is set to 60 mA by resistor R152.

All external AB3/4 board connections are made via the SKBR connector. IC101a decodes the BPF and or doubler/quadrupler path switching logic, with TR104 switching the BFO in/out.

QUADRUPLER: BPF & SECOND DOUBLER (AB3/4 sheet 2)

Circuit diagram: Fig. 7-19.

The doubled signal, from area 1, contains harmonics due to the very nature of the full-wave rectification technique. To remove these unwanted harmonics, the signal is passed through one of three third octave BP filters. The switching of these filters is achieved by using pin diode switches (which are also extensively used elsewhere on the board). Filter pin diode pairs D201 with D204, D202 with D205 and D203 with D206 are switched by transistors TR201, TR202 and TR203 respectively. When the input logic is low (0 V) the associated transistor is switched on, forward biasing the series diode and reverse biasing the two shunt diodes, allowing RF power to pass through. With input logic high (+5 V) the transistor is switched off and the series diode is now reverse biased by -15 V and the shunt diodes are now forward biased shunting the RF signal to earth.

The filtered output at 1.35 to 2.7 GHz is then either taken straight to the output stages or passed on to the second doubling section for quadrupled output. Doubler/quadrupler selection is by pin diodes D207, D208 and D209 which are switched by TR204. When the input logic on the D2 line is low, the transistor switches on, biasing the diodes so as to select the quadrupler path. When the logic is high, the transistor is switched off and bias is applied to the diodes so that the doubler path is selected. When quadrupling is selected the signal is amplified by TR206 and then applied to a similar balanced doubler, formed by D211, to the one used in the first doubling stage. Note that the transistor TR206 is biased by a current source based around TR205.

The quadrupled output at 2.7 to 5.4 GHz is amplified by TR207 and then split by the first Wilkinson divider. The two halves are then applied to transistors TR208 and TR209. The outputs from the two transistors are then recombined by the second Wilkinson divider. This technique of signal splitting, amplifying and recombining gives 3 dB higher maximum output power. The input path lengths are adjusted such that any reflected signals, due to mismatch, are

180 degrees out of phase and therefore cancel, resulting in better input matching. A similar arrangement is also used on the outputs of TR208 and TR209 to the same effect, resulting in good output match.

Transistor amplifying stages TR207, TR208 and TR209 are all active DC biased, similar to the configuration used for TR105. The TR210, TR211 and D212 network prevents +5 V from being applied before the -15 V rail becomes active, in order to avoid damage to the RF transistors. Zener diodes D213 and D214 limit the FET transistor gate voltage to 3.3 V, and thereby prevent gate-source breakdown damage. The divider network of R235 and R236 also provides protection for TR207 by limiting the base voltage to +3.2 V.

QUADRUPLER: BAND-PASS FILTERS (AB3/4 sheet 3)

Circuit diagram: Fig. 7-20.

The amplified quadrupled signal in the range 2.7 to 5.4 GHz coming from area 2 is rich in harmonics, as before. To eliminate these unwanted harmonics the signal is passed through one of the three third octave BP filters, similar to the ones used in the first doubling stage (see sheet 2). Transistors TR302, TR303 and TR304 are used to switch in/out each filter band, which are in turn controlled by TR301. Transistor TR301 selects either the doubler band or the quadrupler band signal to pass through to the next stage. When line D2 is taken low, TR301 switches on and the quadrupler path is enabled. When D2 is taken high, TR301 switches off enabling TR305 to switch on. This forward biases the series diode and reverse biases the shunt diodes in D307 and the doubler path via the 2.8 GHz LP filter is selected for output instead.

The DC bias current setting for pin diodes D304 and D305 is provided by R318 and R319 plus the resistor combinations of R401 to R404 (sheet 4), which add up to about 120 Ω. Diode D306 has a high forward biasing current in order to compensate for higher insertion loss at that frequency band. The doubled and quadrupled outputs are then combined by D308 and D309 and passed onto the output power amplification stages. Diodes D308 and D309 are used to combine signals, instead of a star connection, to achieve higher isolation in the off state; but this also increases the insertion loss.

QUADRUPLER: OUTPUT AMP, LEVELLING & RPP (AB3/4 sheet 4)

Circuit diagram: Fig. 7-21.

Output amplifier

The combined doubled/quadrupled signal passes through the attenuator network of R401 to R404 and into first amplifying stage TR402. The R401 to R404 network plus quarter wave stubs on R401 and R404 reduce attenuation at higher frequencies (4 dB at 1.35 GHz and 2 dB at 5.4 GHz) to compensate for top end frequency losses. Transistor TR403 with R415, R416 and D402 sets the TR402 DC bias source voltage to 0.27 V, which in turn sets the drain current to approx. 50 mA. The combination of TR401 and D401 prevents the connection of the +5 V supply before the -15 V one becomes active which would otherwise damage TR402.

The output power stages based around TR406 and TR410, both have identical biasing networks. Transistors TR405 and TR409 are connected in a 'current mirror' configuration, acting as current sources for TR406 and TR410 respectively. Resistors R423 to R424, R426 and D404 form a potential divider network which sets the base and hence the emitter voltage of TR405 and TR409. The current is set by resistors R422 and R433. The base voltage of transistors TR404 and TR408 is set to approx. 7 V via R425. When TR409 collector potential is less than 7.5 V, TR408 is off and TR410 gate potential is set to -6 V by R427 and R428, turning TR410 off. But when TR409 collector voltage rises above 7.5 V TR408 starts conducting thereby raising the gate potential of TR410, which then starts conducting. When equilibrium is reached, TR410 drain is at approx. 8 V with 350 mA flowing through it. Similarly, TR406 drain is set to 8 V and current to 250 mA. The output signal is passed through a 5.5 GHz LP filter to attenuate the higher harmonics.

Levelling detector

For operations above 1350 MHz where frequency multiplication takes place, the levelling detector on this board replaces that on AB2/2. This is a negative detector and comprises D407 and IC402b. The output power level is detected by detector diode D407, which is biased to its knee point by R443 and R440, with R439 added to flatten the frequency response. Resistor R445 is used to rapidly discharge C426. Op-amp IC402b is configured as a unity gain follower. The output from IC402b is fed out on the DETECTOR line to RF board AB2/2. Temperature compensation for this levelling path is provided by diode D408 and IC402a whose output, on the DETECTOR TEMP COMPENSATE line, is also fed to AB2/2. Output from IC402b is also used to trip the reverse power protection (RPP) circuit.

Reverse power protection

Comparator IC401 non-inverting input (pin 2) is initially set to -3.65 V by resistor chain R435 to R438. When the detected level exceeds -4.8 V, the comparator inverting input (pin 3) is less negative than -3.65 V, and the output goes high (+0.5 V) which reverse biases D405 and D406 and switches off TR407. But when IC401 pin 3 becomes more negative than -3.65 V comparator output goes low (-2 V) thereby forward biasing D405 and D406 which then shunt the RF power to earth. TR407 also is switched on, earthing TR410 gate and thereby turning the transistor 'hard-on', shorting RF power to earth. This action protects the output transistor from high level reverse power damage. The increased current flowing through R437 to R438 has the effect of increasing the potential at pin 3 of IC401 so that the comparator output will now switch back to high level at a higher voltage (on pin 3) than before, i.e. hysteresis effect. The circuit trips after 5 microseconds of reverse power, and remains so until 35 ms after it is removed by the step attenuator RPP trip.

FREQUENCY DOUBLER BOARD - AB3/5

Circuit diagram: Fig. 7-22.

Board AB3/5 is used for the 2031 instrument in place of AB3/1 for the 2030, or AB3/4 for the 2032. The purpose of the doubler board is to take the top octave from RF board AB2/2 in the range 675 to 1350 MHz and double this frequency to produce an output at 1350 to 2700 MHz. Whilst doing this it must preserve any modulation, both in frequency and amplitude, that may be present on the signal. A secondary function, for frequencies from 10 kHz to

21.09375 MHz, is the selection of the path to BFO board AB4/1. For frequencies from 21.09375 to 1350 MHz the doubler path is bypassed. The output stages also incorporate level detection and reverse power protection circuitry.

Signal routeing

The signal routeing is carried out by four relays. Two relays, RLA and RLD, select either the straight through or the doubled frequency path while RLB and RLC are used by the BFO. Two relays are used for each of the functions in order to achieve sufficient isolation in the unwanted signal path. The relays are controlled by TR4, TR5 and TR6. The doubler selection via TR5 and TR6 is an intrinsic part of the decoding logic which provides filter selection. To select the straight through, undoubled, route the relays connect the RF I/P line directly to the output. To select the BFO route the BFO SELECT line from AB2/2 is taken low which switches on BFO Switch Driver TR4 to energize relays RLB and RLC. This connects the RF I/P line via the BFO BAND O/P line to AB4/1, and then from AB4/1 on the BFO BAND I/P line via low-pass filter C44, L14 and C45 to the output. To select the frequency doubled route Doubler Switch Driver TR5 controls relays RLA and RLD. During doubler operation, RLB and RLC are set to the BFO position to isolate the fundamental. Relay operation is summarised in Table 4-2-12.

TABLE 4-2-12 RELAY CONTACTS MADE - AB3/5

Selection	RLA	RLB	RLC	RLD
Straight through	7-5 1-3	7-5 1-3	7-5 1-3	7-5 1-3
Doubler	7-6 * 1-2	7-6 * 1-2	7-6 * 1-2	7-6 * 1-2
BFO band	7-5 1-3	7-6 * 1-2	7-6 * 1-2	7-5 1-3

*energized position

Doubler

The frequency doubler path is selected by relays RLA and RLD which are controlled by decoder IC3a. When IC3 pin 7 is taken high, TR6 is switched on which switches solenoid driver TR5 on. RLA and RLD are then energized as shown in Table 4-2-12 above and the signal on the RF I/P line from AB2/2 is fed into the doubler and then out to step attenuator AT10. The incoming signal is fed in via transformer T1 which provides a balanced signal for the following frequency doubler. Frequency doubling is achieved by full-wave rectification by diode bridge D5. To increase conversion efficiency the diode bridge is biased to bring the operating point closer to the 'knee' and this is provided by the temperature compensated DC bias network of D6 and IC1a. A fixed current is passed through D6 (which is physically close to D5) and the corresponding voltage across it is measured by IC1a. Small value resistor R20 is placed in series with D6 to allow for small variations in diode current so as to compensate for small differences in temperature coefficient between D6 and D5. The resulting voltage is applied to D5 bridge via a quarter-wave stub which provides high impedance to RF signals. The quarter-wave stub isolation technique is used extensively in other parts of the circuitry for applying DC biasing. To counter any instability, TR8 switches on the bandwidth modifying network formed by C62 and R81 whenever the doubler is selected. TR7 provides gain to overcome the 11 dB loss of the doubler. The resulting doubled frequency is fed to the following third-octave filters.

Third-octave filters

Frequency doubling at these frequencies results in considerable amounts of RF power remaining at f/2 (the undoubled frequency) and at 3f/2. To remove these unwanted products, the signal is routed through one of three third-octave filters. Frequency coverage of the filters is: 1.35 - 1.7 GHz; 1.7 - 2.1 GHz; 2.1 - 2.7 GHz.

Filters are selected by PIN diode switches D7 to D12 which are controlled by Filter Switch Drivers IC2 and IC4. These drivers are comparators whose reference thresholds are set by components of R41. Decoder IC3a drives the comparators. To select, for example, the lowest range filter path, IC3 pin 4 is taken low causing IC4c and IC2c outputs in turn to go low. This forward biases the diodes on pins 1 and 2 of D7 and D10 while reverse biasing the diodes on pins 4. This causes the incoming signal to be routed via the 1.35 to 1.7 GHz band-pass filter to the output amplifier.

Output amplifier

TR1 to TR3 provide the power amplification needed to give the 13 dBm output level demanded by the specification. Active DC bias is used on these transistors to guarantee stability of their operating point and hence of linearity. DC bias is supplied by a feedback system based on IC1b, c and d. R40, R42 and R48 are the current sensing resistors for the system. A constant voltage is maintained across each of them by the feedback loop. Because of the power output of the final transistor TR3 it is flange mounted and bolted to the floor of the RF casing for heat dissipation.

Signal levelling

For operation above 1350 MHz where frequency doubling takes place, the Levelling Detector circuit on this board replaces that on board AB2/2. This is a negative detector and comprises D19 and source follower IC5b. The output from IC5b is fed out on the DETECT line to RF board AB2/2. Temperature compensation for this levelling path is supplied by D17 and IC5a, whose output is also fed to AB2/2.

Non-doubled protection

For frequencies below 1350 MHz the signal output level is monitored by the non-doubled RPP (Reverse Power Protection) circuit. This has both positive and negative arms with the stand-off voltages set by Zener diodes D3 and D4 respectively. When the output voltage swing rises sufficiently to cause either D1 or D2 to be forward biased it conducts and so limits that voltage peak.

AB3/2 board operation

Circuit diagram: Fig. 7-23.

Board operation is similar to that described above for board AB3/5, the main differences being that the component references are different and that the doubler path has reverse power protection.

Doubler path protection

For the doubled frequencies the output is monitored by the Doubler RPP circuit. The positive arm is formed by diodes D13 and D14 while the negative arm is provided by TR3. Operation is similar to that of the Non-doubled RPP circuit described above.

BEAT FREQUENCY OSCILLATOR BOARD - AB4/1

Circuit diagram: Fig. 7-24.

Board AB4/1 generates the signal generator low frequency band in the range 10 kHz to 21.09375 MHz. It does this by mixing a reference local oscillator (LO) signal at 104.8576 MHz with an RF signal in the range 104.8676 to 125.96135 MHz.

The reference signal on the LO IN line from control board AA1/2 is fed from PLBM to the tuned LO amplifier. This is based upon TR1 with tuning elements L10 and C14. The amplifier delivers the LO signal at around 17 dBm to the LO port of mixer X1.

The RF signal from one of the AB3 boards (AB3/1, AB3/4 or AB3/5) on the BFO BAND RF IN line is passed through the 135 MHz elliptic low-pass filter formed by C1 to C5 and L1 to L4. This reduces the input harmonic content to the RF port of the mixer. The signal is then attenuated by R1, R2, R3, R26 and R27 to reduce the RF drive level to mixer X1 and thereby reduce the output intermodulation products. Thermal compensation is included in the attenuator using thermistor R27 to counteract drift in RF output level.

Mixer output is low-pass filtered at 35 MHz to reduce harmonic content and is diplexed to absorb the intermodulation products generated by the mixer. The low-pass arm is formed by L5 to L8 and C6 to C8 while the high-pass arm formed by C9, L9 and C10 is terminated in the characteristic impedance of the system to absorb maximum high frequency power.

The low frequency signal is then fed to the 28 dB output amplifier formed by TR2 and TR4. TR4 is a medium power device capable of delivering up to 19 dBm and has active bias using TR3. Output on the BFO BAND OUT line is back to one of the AB3 boards.

The +15 V supply is taken from RF processing board AB2/2 at PLBV and is supplied via the low-pass filter formed by L11, C11 and C12.

FRONT PANEL CONTROL BOARD - AF2/1 & KEY MATRIX BOARD - AF1

Circuit diagram: Figs. 7-25 to 7-27.

Front Panel Control board AF2/1 contains its own microprocessor (a second, main processor is on board AA1/2) plus memory, as well as interface circuitry which controls the front panel functions of display and data entry. Data entry is via keyboard AF1.

FRONT PANEL CONTROL: PROCESSOR AND MEMORY (AF2/1 sheet 1)

Circuit diagram: Fig. 7-26.

Microprocessor and memory

Front panel microprocessor IC2 is an 80C31 which uses an 8-bit data bus and a 16-bit address bus to address its memory and to control the output latch. It derives its clock from 12 MHz crystal XL1. At power on, a reset pulse is provided by R1 and C3. This is inverted by IC10a to provide a reset pulse for LCD controller IC13 (sheet 2).

The processor executes code contained in IC12, a 64 kbyte EPROM containing the operating program. PSEN provides the active low read strobe for IC12, and is equivalent to RD for the screen memory. The 128 bytes of RAM contained within the 80C31 (giving fast access) and used for scratch-pad purposes are supplemented by 8 kbytes in RAM IC15.

The processor uses a multiplexed data bus to accommodate the 16-bit address. Output lines A8 to A15 on port P2 carry the high order memory address. Input/output lines D0 to D7 on port P0 carry either the low order memory address or the data. ALE (Address Latch Enable) is used to differentiate between data and address; when it is taken high the contents of the data bus are treated as part of the address and latched in IC4. The high order address bits on port P2 are decoded by IC3 to provide chip select signals for the RAM and for the various peripheral devices on the board. WR (write) and RD (read) come from two lines of Port 3.

Key matrix AF1 is an 8x5 matrix of 40 keys connected to the Keyboard Column Driver latch IC1 (AF2/1 sheet 2) and 5 lines of Port P1 on the microprocessor configured as inputs. When no key is pressed, all latch outputs are low and P1.2 to P1.6 are pulled high by internal pull-up resistors. Any key press will cause one of these inputs to be taken low. This is detected by software which initiates a scan of the keyboard to determine which key has been pressed.

Ports P1.0 and P1.1 form a two-line interface to the real time clock on power supply board AR1. When not in use, both ports are held logically high.

The control knob is connected to a shaft encoder which generates two trains of pulses, X and Y, which are interfaced with the microprocessor at Port P3. As the shaft is rotated the pulses generated are decoded by the processor to determine the direction and rate of movement of the control. P3.4 is an input from the X train, while the Y train is an input which generates interrupt signal INT1. IC9a is an EX-or gate which is used to invert the interrupt signal under the control of output P3.5. When the knob is not being turned, the INT1 input will be logically high.

Communication interface

The overall operation of the communication interface is covered in the description for AA1/2 sheet 1. The following describes the operation of the interface performed by the front panel processor.

The front panel microprocessor communicates with the main microprocessor via a serial link. The serial interface in IC2 is used in shift register mode. In this mode, RX/TX on pin 10 is used to transmit or receive data, while SERIAL CLOCK on pin 11 is the clocking output. The

bidirectional data is split onto separately buffered transmit (TX) and receive (RX) lines by IC10b and IC9b. The direction is controlled by port P1.7 (pin 8). This control line is buffered by IC9d and sent to the main processor together with a serial clock on the SCL line, buffered by IC9c.

Three further lines are concerned with synchronization. Two inputs, RRQST (Receipt ReQueST) and RACK (Receipt ACKnowledge) are used to set and reset two R-S bistables formed from the gates of IC7. The RRQST bistable output generates interrupt INT0 to the microprocessor. When required, the states of the outputs are read using the Interrupt Readback Buffers IC10c and d to produce data bits D0 and D1. A write to the same address generates the BTF (Byte To Follow) pulse. The bistable are cleared by the processor using IC8a and b.

FRONT PANEL CONTROL: LCD CONTROLLER (AF2/1 sheet 2)

Circuit diagram: Fig. 7-27.

Contrast and brightness control

The data written to Contrast Control latch IC5 is used to control the LCD contrast and backlight brightness. The three least significant bits control the current supplied to the display backlighting invertor at PLFM contact 2. Current from the +24 V rail of the power supply passes through interference filter L1, C19 and C20 to the current invertor and then to earth via Brightness Control IC19. When bit 2 of the data to IC5 is set, the resistors on the outputs of IC19 are by-passed and full brightness is obtained. When bit 2 is low, bits 0 and 1 are used to enable two sets of series resistors, R16 to R19 and R20 to R23 to be interposed either singly or in parallel giving three lesser stages of brightness. If all three bits are low, the backlight is turned off. The remaining data bits to IC5 control a 5-bit D-A converter formed by R9 to R13 and IC6. This provides a voltage, of approximately -11 V to the LCD, which is adjusted to set the contrast and viewing angle. This output may be disabled by TR2 (see below). Thermistor R3 provides temperature compensation to match the LCD characteristics over the temperature range of the instrument.

LCD controller and screen memory

The LCD (Liquid Crystal Display) unit is driven by LCD Controller IC13 which provides the necessary signals on connector PLFG to the LCD unit. The controller has a 10 MHz clock derived from crystal oscillator XL2. At power-on the RST input is supplied with an active-low reset pulse from IC10a (sheet 1). Inputs SEL1 and SEL2 are tied low to select operation under control of the 8031 microprocessor. Lines D0 to D7 convey data to and from the front panel processor when addressed on chip select line CS3. A0 operates in conjunction with the active-low RD and WR signals. For a read, either data or the status flag is read from Screen Memory IC14. For a write, either commands or data are strobed into memory.

The controller is connected to IC14, a 32 kbyte RAM which stores the screen data. Outputs A0 to A14 convey the 15-bit address which is latched into the memory on the trailing edge of the pulse from VCE. VD0 to VD7 are tristate outputs connected to the 8-bit bi-directional data bus. The data is controlled by VR/W which is taken high or low respectively to indicate when the read or write data is settled and valid.

XD0 to XD4 supplies the 4-2-bit data word for the display module. The trailing edge of the XSCL signal causes the pixel data to be stored in the display. LP supplies the line synch pulse while YD supplies the frame synch pulse. WF is active high for the duration of a frame which has a frequency of 70 Hz.

Were the LCD controller to become disabled, output YD15 would go low which would switch off TR1 supplying base current to TR2. This in turn would switch off to remove the VLCD signal so as to disable the display.

LCD column corrector

The circuitry comprising IC16, IC17, IC18 and IC11 inhibits 12 pulses of the XSCL control line to match the controller to the LCD unit. IC16 is configured as an 8-bit binary counter which counts the XSCL pulses from the LCD controller. The ongoing count is supplied in parallel to comparators IC17 and IC18. IC18 compares this data with 100 while IC17 compares it with 112. When no match is found both output pins 19 are logically high. But when a count of 100 is reached, IC18 outputs a low pulse. This takes IC11 pin 2 high and, with pin 1 already high, a low is output to pin 9 which gates off the XSCL pulses. Not until a count of 112 is reached, when IC17 pin 19 goes low, is the gate reopened. By this means only 400 pixels are displayed per line as required.

Board AF1 differences

This board is very similar to AF2/1 except that the RRQST and RACK R-S bistables are ORed together to generate processor interrupt INT0. Also TR1 and TR2 are not present.

PSU BOARD - AR1

Circuit diagram: Fig. 7-28.

Board AR1 provides the power supply voltages of +5 V, +15 V, -15 V, +24 V and +26 V for the instrument, the edgeline attenuator coil drive, the real time clock and the brown-out circuitry. The unit has current limiting on the voltage rails and thermal shut-down in case of overheating. TR1, TR2, TR3, IC2, IC3 and thermistor R12 are all mounted on an aluminium heatsink which is cooled by a fan on the rear panel assembly. The power supply voltage rails are derived from the mains transformer four secondary voltages which are connected to the board at PLRB and PLRR. This board also contains the real time clock and the internal standard disable switch.

Power supplies

The +24 V secondary on PLRB contacts 1 and 2 is rectified by D1 and smoothed by C3. This voltage is then used to supply the instrument's +24 V and +26 V voltage rails.

The +24 V rail supply is generated by a specific monolithic regulator, IC2, and is used to drive the invertor on the front panel from PLRG.

The +26 V rail supply is generated using a standard monolithic regulator, IC3. It is obtained using a feedback loop where the rail voltage is potentially divided by R6 and R7 and is

compared on pins 2 and 3 of IC4a with the precision +5 V reference from IC5. Op-amp output is then used to drive adjustment pin 1 of IC3 and so regulate the rail.

The -15 V secondary is connected to contacts 3 and 5 of PLRB and is rectified by D4 and smoothed by C8. The -15 V rail voltage is potentially divided with the precision +5 V reference from IC5 by R18 and R19. The divided voltage on pin 3 of IC6 is compared with 0 V on pin 2 and the difference is amplified and used to drive the gate of the regulating MOSFET TR1. R13 is the current sensing resistor which, when the current limit is exceeded, turns on TR5 to reduce the TR1 gate-source voltage and so turn it off.

The rectified +15 V secondary is connected to contacts 1 and 2 of PLRR and is smoothed by C12. This voltage is used for the regulated +15 V rail, the edgeline attenuator coil drive and the fan.

The regulated +15 V rail is obtained using a feedback loop where the rail voltage is potentially divided by R30 and R31 and is compared by IC9b pin 6 with the precision +5 V reference on pin 5 from IC5. The difference is then amplified and used to drive the gate of the regulating MOSFET TR2. R25 is the current sensing resistor which, when the current limit is exceeded, causes the output of IC9a to go low turning off TR2 and hence limiting the current.

The rectified +5 V secondary connected to contacts 3 and 5 of PLRR is smoothed by C17. This voltage is used for the +5 V regulated supply and to provide an input to the brown-out circuitry. The +5 V regulated supply is obtained by using a feedback loop where the rail voltage is compared by IC9d pin 13 directly with the +5 V reference on pin 12 from IC5. The difference is amplified and used to drive the gate of TR3. R36 is the current sensing resistor which, when the current limit is exceeded, causes the output of IC9c to go low turning off TR3 and so limiting the current.

IC5 supplies the +5 V reference for the board and is driven by IC4b. The thermal shut-down of the PSU is controlled by this IC. When the difference in sensed temperature between the ambient thermistor, R10, and the heatsink-mounted thermistor, R12, causes the output of IC4b to go low, it turns off the +5 V reference and thus all of the power supply voltage rails.

IC7, IC8 and IC10 are run off the unregulated +15 V supply. IC10 is used as a current source to drive the edgeline attenuator reverse power protection (RPP) relay while ICs 7 and 8 are used to provide a +5 V supply to the relays on the edgeline attenuator.

When the +5 V unregulated supply falls below the +5 V reference, the output of IC4c goes high and this is taken off the board at PLRD and PLRE to indicate a brown-out (incipient power supply failure). When this happens a pulse is generated by the timing components C22 and R44 causing IC4d to transmit this pulse to the edgeline attenuator to trip the RPP relay.

The fan is driven by the unregulated +15 V rail and this is taken from the board at PLRC.

Real time clock

Real time clock IC1 is located on this board and its output is taken to the front panel at PLRG. The timing is derived from 32.768 kHz crystal XL1. The operation of the IC is maintained by a battery mounted on the rear panel and connected to PLRH.

Internal standard disable switch

Transistor switch TR4 supplies +5 V power to the internal standard OCXO on board AR2. TR4 is used to disable the internal standard when the external standard is selected. Control is exercised by AA1/2 which takes PLRD contact 4 high to switch off the transistor.

INTERNAL FREQUENCY STANDARD BOARD - AR2

Circuit diagram: Fig. 7-29.

Board AR2 contains the 10 MHz OCXO (oven controlled crystal oscillator) which provides the internal frequency standard for the instrument. Overall operation of the frequency standard (both internal and external) is explained under AA1/2 sheet 6.

The +15 V power for the OCXO heater is supplied from PSU board AR1 to PLRL contact 1 with additional smoothing provided by C1. The +5 V power is also supplied by AR1, this is fed in from PLRL contact 2 via a low-pass filter formed by C2, L1 and C3. This power is switched off during external standard operation in order to prevent crosstalk or beating occurring. The switching signal is OCXO POWER ON from board AA1/2 which controls switching transistor TR4 on board AR1. PLRL contact 9 carries the OCXO TUNE signal from AA1/2 via AR1. Output at TTL levels to PLRM supplies the internal standard to AA1/2.

EDGELINE CONTROLLER BOARD - AT11 & ATTENUATOR UNIT - AT10

Circuit diagram: Fig. 7- 30.

Edgeline controller board AT11 performs three basic functions. It enables any desired attenuator pad configuration to be set, it holds on-board calibration data for each pad in an EEPROM, and it provides the detection and tripping circuits for the reverse power protection facility for the RF output of the instrument.

Communication with the main processor on AA1/2 is via PLTC which is connected to the 4-2-bit nibble bus to AA1/2. It uses front panel control board AF2/1 as a mini-motherboard to establish this link. Address information from buffer IC2 is latched into IC9 before being decoded by IC10. IC10 is used to clock valid data into the appropriate latches.

Attenuator operation

The pad selection data is expanded to an 8-bit byte to reduce circuit complexity as the attenuator contains 12 pad-driving solenoids (one each for inserting and removing a pad). This expansion is done by using IC5 to hold one 4-2-bit nibble (the least significant) and using the current valid data as the most significant nibble. The full 8-bit byte is then loaded into either Pad Insert Latch IC6 or Pad Removal Latch IC7. These devices control the switching of the pads by means of TR1 to TR12. Resistor packs R6 and R7 set the base current for the transistor switches, while R22a and b pull the latches' tristated outputs down to earth when they are in the high impedance state.

To reduce power consumption the solenoids are pulsed. The pulses are provided by Timing Monostables built around IC11a and IC12a, b and c. Three pulses are generated, one to activate the insertion of the pads, one for the removal and then a gap between these to ensure that they are inserted before any are removed. This ensures that there is always a drop in the output RF level whenever the attenuation is changed. Schmitt invertor IC12a with timing components C1 and R3 generates the first 20 ms pulse for Pad Insert Latch IC6. IC12c with C3 and R5 generates the final 20 ms pulse to Pad Removal Latch IC7 while IC12b with C2 and R4 generates a 10 ms delay between these two events.

Calibration data for each pad is held on-board in serial input EEPROM IC4. Information is written to this device during the factory calibration of the attenuator unit. However, the device is addressed each time the instrument is switched on to transfer the data to the more local, high speed, memory on processor board AA1/2. The EEPROM is under the control of latch IC3.

Reverse power protection

The RPP (Reverse Power Protection) trip facility is provided by IC14. The signal level at the output of the attenuator is sensed by two diodes within the attenuator assembly which make contact with PLTE contacts 1 and 2. If this level exceeds the predefined level set by R16, R18, R19 and R21 the window comparator formed by IC14a and b trips. Schmitt invertor IC12e, using timing components C6 and R10, then generates a 20 ms pulse via IC12f and D11 which turns on TR13. This transistor drives solenoid RLG2 so disconnecting the damaging signal from the rest of the instrument. To restore the RPP, the appropriate address is selected by IC10 which resets IC13a. This causes IC12d with C4 and R8 to generate another 20 ms pulse, switching on TR14 which energizes relay RLG1, so restoring normal operation.

IC1c prevents this relay stage from resetting should a request to reset the RPP be received while the overload condition persists. To ensure that the RPP relay is forced open when the instrument is powered down, a SHUT-DOWN signal (PLTD contact 3) from PSU board AR1 is wire OR-ed by D11 with the existing on-board signal.

The pad relays are driven from the +5V(H) rail (PLTD contact 8) while the RPP stage is driven from a separate rail which is current limited to 0.5 A (PLTD contact 6). The latter rail runs from the +15 V reservoir capacitor on the PSU board to ensure that a pulse of duration greater than 20 ms is delivered to the RPP relay during the power down of the instrument.

The 4-bit nibble bus is bi-directional so allowing the microprocessor on AA1/2 to read back the data from cal EEPROM IC4 as well the current status of the RPP circuit from IC13a. This function is selected by enabling either IC1a or IC1b which then presents the data on nibble bus line D1 or D0 respectively. Resistors R1 and R2 prevent bus contention should the board be addressed while IC1a or IC1b is still active.

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Chapter 5-0
MAINTENANCE

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INTRODUCTION

This chapter provides servicing support information for the three chapters which follow:

5-1: PERFORMANCE TESTING - procedures for verifying that the equipment complies with the Performance Data in Chap. 1.

5-2: ADJUSTMENT AND CALIBRATION - tests and adjustments for restoring the equipment to peak performance.

5-3: FAULT DIAGNOSIS - procedures for localizing faults to at least sub-assembly level (normally a printed circuit board), together with information on repair and replacement.

In case of difficulties which cannot be resolved with the aid of this manual, please contact our Service Division at the address at the rear of the manual for your nearest Marconi Instruments representative. Always quote the type number and serial number found on the instrument data plate.

SAFETY PRECAUTIONS

Although this equipment has been designed and constructed in accordance with international safety standards, it is important that the advice given under 'Servicing Precautions' at the front of this manual should be observed in all maintenance procedures to ensure safe working practices. In addition to these precautions, special handling techniques are required for certain items, as below.

General precautions

Chip components. Numerous chip capacitors and resistors are fitted in this instrument. These have silver palladium end cap terminations with nickel barriers. When soldering these devices the following precautions should be observed.

(i) Use a low melting point solder, and a soldering iron set to 315°C (600°F). The use of a high wattage soldering iron will minimize the time taken to solder the device.

(ii) Take care to avoid mechanical damage from flexing the PCB.

Static sensitive components. The CMOS integrated circuits used in this instrument have extremely high input resistance and can be damaged by accumulation of static charges (see preliminary pages, 'Servicing Precautions'). Boards that have such integrated circuits all carry warning notices against damage by static discharge. Take care also when using freezer sprays to aid fault finding. These can create a static charge likely to change the programmed memory of (E)PROMS.

Bulkhead connectors and gaskets. To ensure that no RF leakage occurs all bulkhead connectors and lid sealing gaskets must be securely fitted. It is essential that the unit lids are correctly relocated in their slotted recesses after removal and all the screw type connectors are tightened up to their specified torque (see 'Torque setting' below).

Torque setting. When replacing semi-rigid pipe connections it is imperative that the following torque setting is used:-

SMA : 99 to 106 N-cm

TEST EQUIPMENT

The test equipment for use in Chaps. 5-1 and 5-2 is shown in Table 5-0-1. Alternative equipment may be used provided it complies with the stated minimum specification.

TABLE 5-0-1 TEST EQUIPMENT

Description	Minimum specification	Example	Use@
Power meter	±0.1 dB from 10 kHz to 5.4 GHz	Marconi 6960A and 6910 or 6912 sensor	PA
Measuring receiver	0 dBm to -127 dBm; 2.5 MHz to 1300 MHz	HP8902A and 11722A sensor and 11793A down converter	P
Signal generator	8 dBm from 1.3 to 5.4 GHz	Marconi 2032	P
Frequency counter	10 Hz to 2.7 GHz	Marconi 2440	P
Audio analyzer	Capable of measuring THD below 0.03% from 100 Hz to 20 kHz. Capable of measuring 0.5 mV ±3% and levels at 10 Hz	HP8903B Rhode & Schwarz UPA3	P
Digital multimeter	DC to 500 kHz, 1 mV to 5 V	Datron 1061A	P
Digital voltmeter (DVM)	DC to 100 kHz	Solatron 7150+	A
Modulation meter	AM, FM and FM. 1.5 MHz to 1 GHz. Accuracy better than 1.1%. Modulation freqs from 30 Hz to 50 kHz	Marconi 2305 plus distortion option*	PA
Spectrum analyzers	10 kHz to 8 GHz	Marconi 2386	P
	10 kHz to 1.35 GHz	Marconi 2383	A
Function generator	DC to 500 kHz sine wave ±0.6 dB flatness	HP3325B	PA
DC source	-1.5 V DC ±0.1 V	Marconi 2155	A

@ P = Performance testing A = Adjustment and calibration

* The distortion option of the 2305 Modulation Meter allows modulation distortion tests to be carried out with greater ease. If a 2305 with a distortion option is not available, the Audio Analyzer may be connected to the Modulation Meter LF output and set to measure distortion.

ACCESS TO UNITS AND BOARDS

The procedures below follow the order of access for servicing, removal of units and boards and operation with RF tray removed.

ACCESS FOR SERVICING

Removal of outer covers

To remove either the top or bottom outer cover it is first of all necessary to remove the 2 rear support feet. This involves prising off the 2 plastic plugs in each of the feet and removing the screws and feet. Next remove the single retaining screw at the centre rear of the cover. Slide the cover slightly to the rear then lift off.

Most servicing is performed commencing with removal of the top outer cover. However, removal of the bottom outer cover enables the RF attenuator to be taken out as a unit and also enables the power supply board to be removed.

Access to board AA1/2

Remove the top outer cover which reveals the top of the RF tray. Remove the top tray cover after removal of 33 M4 and 4 M3 screws to gain access to the board (see Fig. 5-0-1).

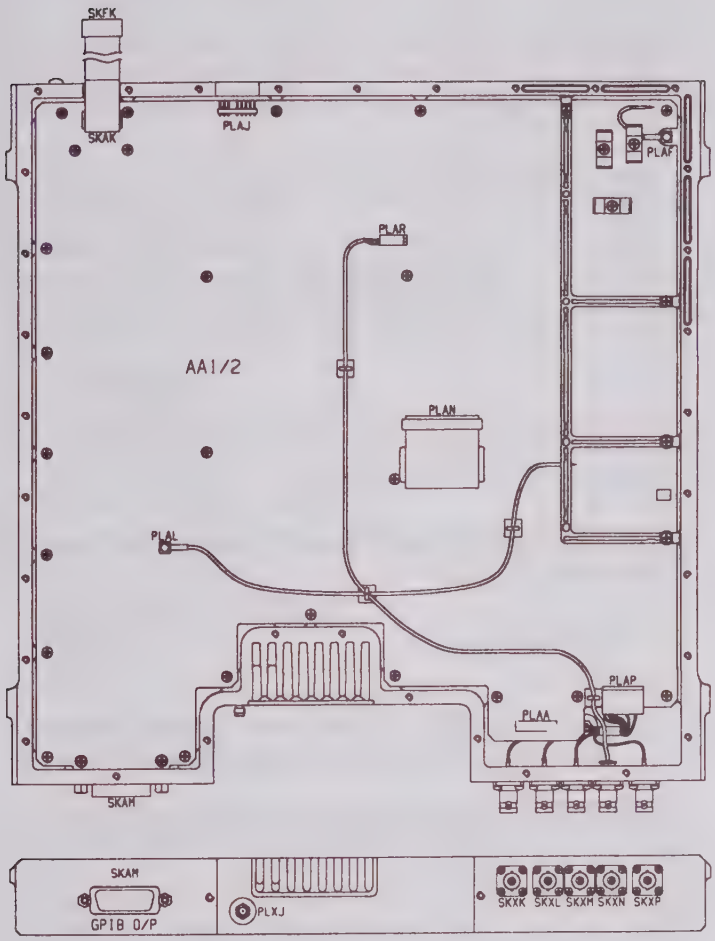

Fig. 5-0-1 RF tray from above and rear with tray cover removed showing board and locations of connectors

Access to boards AB1, AB2/2, AB3/x and AB4/1

Remove the top outer cover and the RF tray (see 'Removal of RF tray' below). Turn the tray upside down to gain access to the underside. Remove the bottom tray cover after removal of up to 35 M4 and up to 19 M3 screws (depending on version of instrument) to gain access to the boards. Note that any screws which are blue varnished are not to be removed. Only one of boards AB3/1, AB3/3, AB3/4, AB3/5 is fitted depending on version of instrument. An internal view of the RF tray from below for the standard version is shown in Fig. 5-0-2 and for the pulse mod version in Fig. 5-0-3.

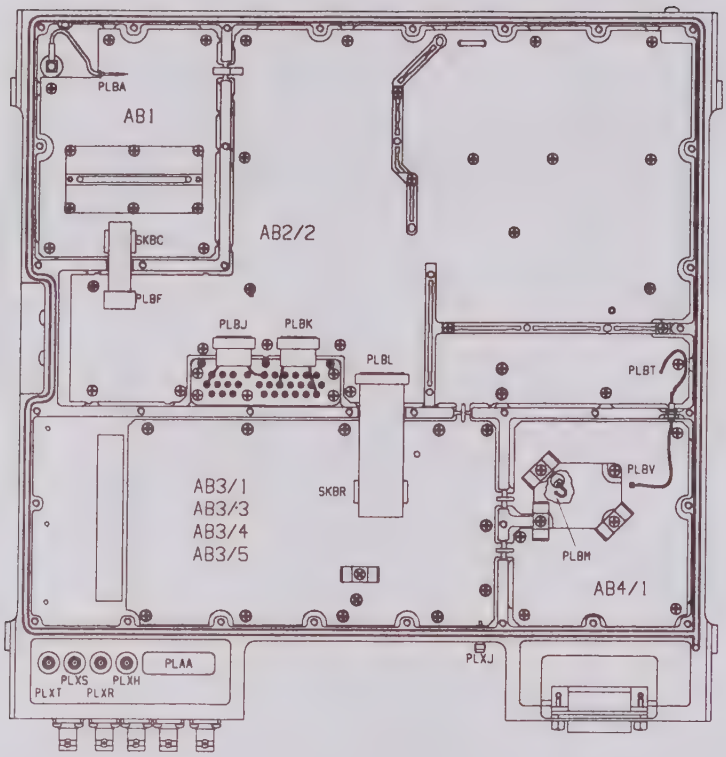

Fig. 5-0-2 RF tray from below with tray cover removed showing locations of boards and connectors for standard version

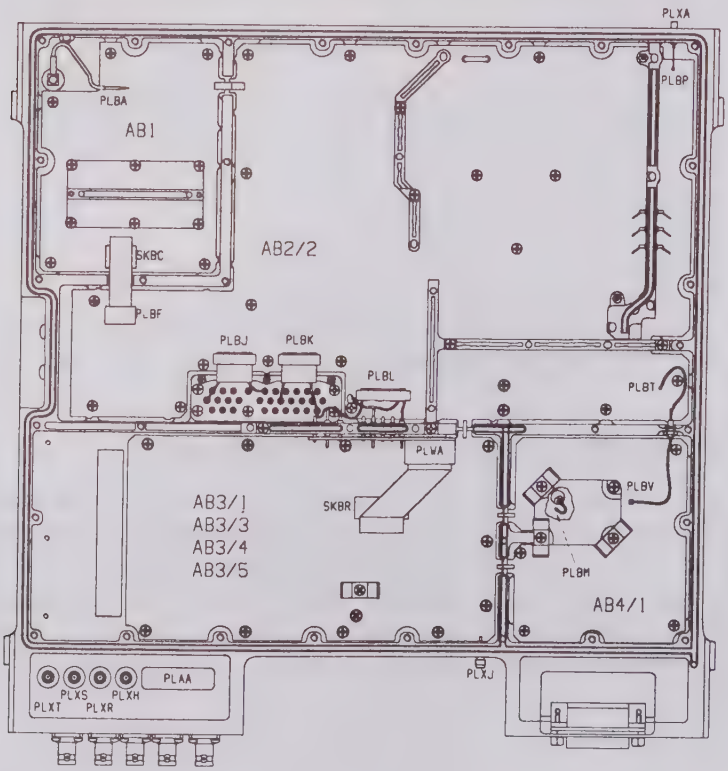

Fig. 5-0-3 RF tray from below with tray cover removed showing locations of boards and connectors for pulse mod version

Access to boards AF1 and AF2/1

To access these boards the complete front panel assembly containing the boards must be removed (see 'Removal of front panel assembly' below). Having done this, further disassembly is necessary (see 'Removal of boards AF1 and AF2/1 from front panel assembly' below).

Access to power supply and boards AR1 and AR2

Remove the top outer cover and the RF tray. This gives access to the power supply unit and boards, which are mounted at the rear of the instrument, from above. If required, the power supply board may be removed (see 'Removal of power supply board AR1' below).

Access to board AT11

Remove the top outer cover and the RF tray. This gives access to the board, which is mounted on the attenuator, from above. For greater access the complete attenuator must be removed (see 'Removal of attenuator unit' below).

REMOVAL OF UNITS AND BOARDS

Removal of RF tray

Most servicing requires removal of the RF tray. This is a machining which rests on lugs at the sides and is held in place by 8 M4 panhead screws. Proceed as follows:

(1) Unscrew semi-rigid SMA output cable to the right of the fan.

(2) Pull off the connector containing 3 coaxial cables in a black housing at the front right (viewed from the front) of the tray.

(3) If pulse modulation (Option 002) is fitted pull off flexible SMB cable to front right bottom corner of the tray.

(4) Remove 3 screws each side (2 at front, 1 at rear) and 2 on the back panel (mid-upper of panel at sides of fan).

(5) Lift front of RF tray just enough to gain access to the connectors at the rear left of the underside of the tray. Pull off a flexible coaxial cable and an 11-way multiple cable.

(6) Lift the RF tray directly upwards and remove.

Replacement is generally a reversal of the above removal procedure. Ensure that the correct torque setting is used when replacing the semi-rigid cable connection (see 'Torque setting' above). An internal view from above with the RF tray removed is shown in Fig. 5-0-4.

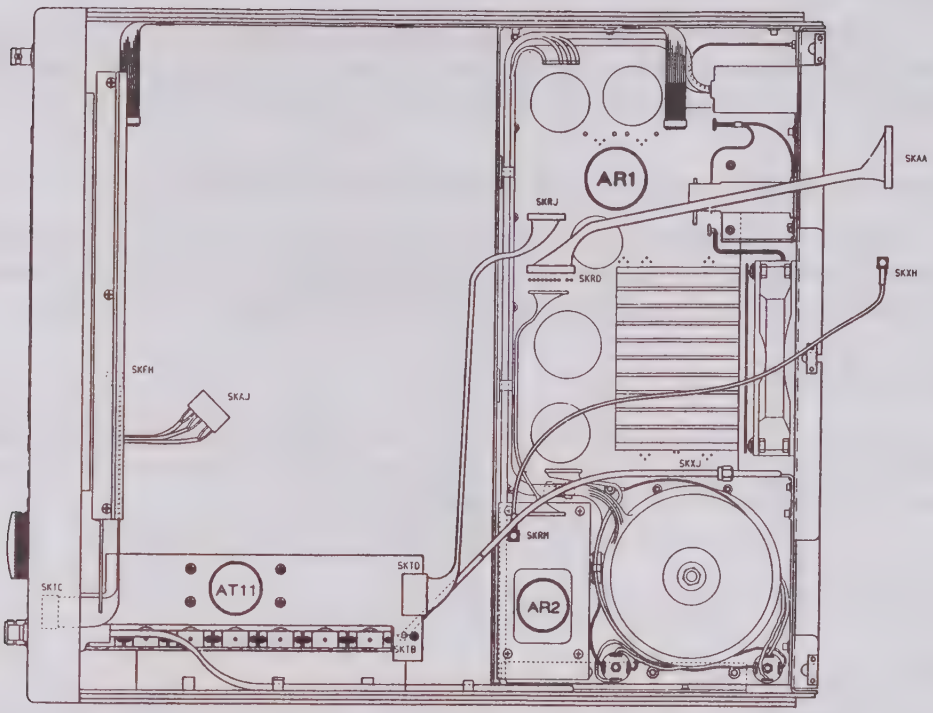

Fig. 5-0-4 Instrument from above with RF tray removed showing locations of boards and connectors

Removal of front panel assembly

Proceed as follows:

(1) Using a screwdriver blade prise off the plastic infills in each of the front panel handles. Remove the 2 M4 panhead screws securing each handle and remove the handles.

(2) Remove the 2 M4 countersunk screws holding the front panel assembly to the mainframe.

(3) Pull off the front panel power supply cable at left-hand rear (viewed from the front) of the panel.

(4) Gently pull the front panel unit away from the mainframe whilst easing the RF OUTPUT socket through the plastic grommet. When able to do so, pull off the remaining connectors. Note the positions of these connectors for later reconnection.

(5) Undo the 2 screws at the right-hand rear of the panel to release the SUPPLY switch.

Replacement is generally a reversal of the above removal procedure. For the locations of the connectors refer to the component layout for AF2/1 in Chap. 7.

Removal of attenuator unit

Proceed as follows:

(1) Remove the bottom outer cover and invert the instrument.

(2) Unscrew the SMA cable facing upwards (viewed from underside of instrument) at the rear of the attenuator.

(3) Remove 2 countersunk M4 screws from the right sidewall of the mainframe. These are at either end of the cut-out in the frame.

(4) Pull off backwards the 8-way supply connector from the rear of board AT11.

(5) While supporting the attenuator, push against the front of the RF OUTPUT socket so that it is eased through the plastic grommet.

(6) Pull down and off the 10-way ribbon cable from the front of board AT11. Remove the attenuator unit.

Replacement is generally a reversal of the above removal procedure. Ensure that the correct torque setting is used when replacing the semi-rigid cable connection (see 'Torque settings' above).

Removal of board AA1/2

Remove the RF tray and gain access to the board. Then proceed as follows:

(1) Pull off the following connectors:-

9-way connector PLAP,
SMB connector PLAF,
SMB connector PLAL,
34-way ribbon connector PLAN,
3-way coaxial connector PLAR and disengage from cable clips.

(2) Remove the 2 fixing studs on rear face of tray for GPIB connector SKAM.

(3) Unscrew and remove the spring finger and round spacer adjacent to SMB connector PLAF.

(4) Remove all M3 recessed panhead screws (24 peripheral - including 4 in the screen - and 4 inboard). Leave the 2 screws fixing the spring fingers, front left.

(6) Lift the board up by the plastic loop at the front, just enough to clear the side wall, and pull the board out forwards to disengage the GPIB connector from the rear wall opening. Remove the board.

Removal of board AB1

This is the only double-sided board in the instrument. Having gained access to the board proceed as follows:-

(1) Pull off the following connectors:-

SMB connector PLBB,
10-way ribbon connector PLBC.

(2) Unsolder the board link to AB2/2.

(3) Remove all M3 screws, take away cover, and remove the board.

Removal of board AB2/2

Having gained access to the board proceed as follows:-

(1) Pull off the following connectors:-

10-way ribbon connector PLBF,
20-way ribbon cable PLBL,
two 16-way ribbon cable PLBJ, PLBK.

(2) Unsolder PLBT. Unsolder links to AB1 and to AB3/x. If pulse mod is fitted unsolder PLPB.

(3) Remove all M3 screws and take away 2 screens.

(4) Remove 2 M2.5 screws adjacent to R/F OUTPUT and remove the board. Note that on the rear of the board, under IC2, there is a 2-leaf spring which must be protected following board removal.

Removal of boards AB3/1, AB3/3, AB3/4 and AB3/5

Having gained access to the board proceed as follows:-

(1) Pull off 20-way ribbon connector from board AB2/2. If the pulse mod option is fitted in 2031 or 2032, disconnect the ribbon cable from the PCB on side wall.

(2) Unsolder 2 links to AB4/1. Unsolder link to AB2/2.

(3) Remove peripheral M3 screws. Remove M2.5 screws.

(4) Unsolder RF output connection and unscrew SMA connector PLXJ from the RF tray. For AB3/4 the SMA connector is fitted in a square brass bush which is to be unscrewed complete.

(5) Remove the board whilst protecting relays on the back of board.

Removal of board AB4/1

Having gained access to the board proceed as follows:-

(1) Unsolder 2 links to AB3/x. Unsolder PLBV.

(2) Remove 4 cover fixing screws and remove cover.

(3) Unsolder PLBM.

(4) Remove M3 screws and remove board.

Removal of boards AF1 and AF2/1 from front panel assembly

Proceed as follows:

(1) Unplug PLFF from board AF1. Unplug PLFL, PLFM and PLFG from AF2/1.

(2) Undo the 6 screws holding the rear cover and remove. This enables the rear of board AF2/1 to be accessed.

(3) Undo 2 screws from the inverter box and pull the box aside.

(4) Remove 6 screws from the support plate to remove AF2/1.

Further disassembly is inadvisable due to the likelihood of dust contamination. If necessary, continue as follows:

5) Undo 4 screws from the support plate and remove.

(6) Undo 4 screws at the corners of the display unit and remove. This gives access to the rear of keyboard AF1.

(7) Pull off the control knob. Remove the block after loosening the self-tapping screw and remove washer.

(8) Unscrew all hexagonal pillars, remove 3 slotted panhead screws and 4 recessed panhead screws. Board AF1 may now be removed.

Replacement is generally a reversal of the above removal procedure. But note that the screen glass window and the face of the display must be cleaned by an anti-static cleaner before reassembly.

Removal of power supply board AR1

Proceed as follows:

(1) Remove the bottom outer cover and invert the instrument.

(2) Remove 15 M3 screws from the board (do not disturb the remaining 6 screws which are for the heatsink). Gently lift the board from the mainframe while pulling off 8 connectors. Note the positions of these connectors for later reconnection.

(3) Left within the mainframe are the mains transformer, rectifiers, battery holder, mains inlet and cooling fan.

Replacement is a reversal of the above removal procedure. For the locations of the connectors refer to the component layout for AR1 in Chap. 7.

Removal of board AR2

Having gained access to the board proceed as follows:-

(1) Pull off the following connectors:-

10-way ribbon connector PLRL,
SMB connector PLRM.

(2) Remove M3 screws and remove board.

Removal of board AT11

Having gained access to the board proceed as follows:-

(1) Pull off 3-way connector PLTE.

(2) Unsolder 3 solder joints for each solenoid.

(3) Remove all board screws and remove board.

RF TRAY OPERATION REMOVED FROM MAIN UNIT

For servicing purposes the RF tray may be removed and operated, connected to the instrument by a number of cables. Lay the RF tray to either side of the instrument and facing the same way. Note that cables numbered in brackets below are supplied in the optional Maintenance Kit, 46884-444G.

The following cables are required between the named connectors:-

(1) SKTB on attenuator to SKXJ on the RF tray:
SMA-SMA flexible coax, 0.8 m (43137-785T).

(2) PLRM on frequency standard AR2 to PLXH on the RF tray:
SMB-SMB flexible coax, 0.75 m (43137-786P).

(3) PLRD on power supply AR1 to PLAA on AA1/2:
Female-female 11-way individual wires, 0.65 m (43137-787X).

(4) SKAJ to PLAJ on AA1/2:
Three coax extension cable, male to female, 9-way housings, 0.8 m (43137-788M).

(5) PLFK front panel AF2/1 to SKAK on AA1/2:
Female-male 16-way extension cable, 0.5 m (43137-789C).

(6) If pulse option fitted, PLXA to SKXA:
SMB-SMB, female to male flexible coax extension cable, 0.5 m (43137-790X).

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Chapter 5-1
PERFORMANCE TESTING

For these tests refer to Chap. 5-1 Acceptance Testing, in the Operating Manual.

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Chapter 5-2
ADJUSTMENT AND CALIBRATION

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INTRODUCTION

This chapter describes adjustments which will restore the instrument to its peak operating condition. Test equipment recommended for this purpose is listed in Chap. 5-0 and summarized for each test procedure. All of the adjustments for the instrument can be carried out from the front panel.

Test equipment

During the adjustment of the instrument ensure that all the test equipment used is calibrated. Correction figures should be applied where necessary and instruments zeroed if required.

Warm-up time

Allow the instrument to warm-up for at least 15 minutes before calibration.

Key symbols

Note that the **[HARD]** keys are shown in capitals in square brackets and the *[soft]* keys in italics with square brackets.

Unlocking procedure

In order to access the calibration routines it is necessary to unlock the instrument to level 2. Proceed as follows:-

[UTIL] *[Utils. Menu 2] [Lock & Unlock] [Unlock Level 2]*

Key in the password then press enter. (The default password to unlock to Level 2 is 123456.)

Check that the display confirms that the instrument has been unlocked to Level 2.

CALIBRATION AREAS

There are 5 areas of the instrument that require calibration:

(1) Source and path calibration
(2) RF calibration
(3) FM calibration
(4) Modulation calibration
(5) Frequency standard

To ensure that the adjustment remains in specification over the calibration period it is advisable to ensure that the figures remain within the +5% and +95% limits stated at the beginning of each section.

TEST PROCEDURES

1 SOURCE AND PATH CALIBRATION

	TEST EQUIPMENT	
Description	**Minimum specification**	**Example**
Digital volt meter (DVM)		Solatron 7150+
AF source	1 kHz sine wave	HP 3325B

ADJUSTMENT	
Source path/calibration	
Source	Path
External Mod 1 (reference)	AM 1
External Mod 1 ALC	AM 2
External Mod 2	FM 1
External Mod 2 ALC	FM 2
Internal Source 1	LF
Internal Source 1	
Internal Source 2	
Full calibration figure range:	0 to 65536
5% to 95% calibration figure range:	1638 to 63898

Setting the reference voltage

(1) Connect the AF source output and the DVM input via a T-connector to the EXT MOD 1 INPUT on the UUT. Equipment configuration is shown Fig. 5-2-1.

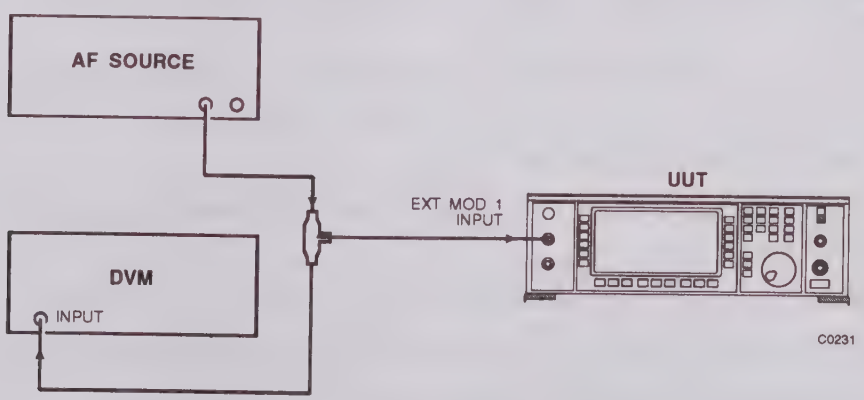

Fig. 5-2-1 Equipment configuration to set the reference voltage

(2) Unlock the instrument to level 2 then select source/path cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [Source/Path]*

(3) Set the AF source to 1 kHz and adjust the output level until the DVM reads 1 V ±0.08 V RMS.

Measuring the LF output level

(1) Connect the AF source to the EXT MOD 1 INPUT on the UUT. Connect the LF OUTPUT on the UUT to the DVM input. Equipment configuration is shown in Fig. 5-2-2.

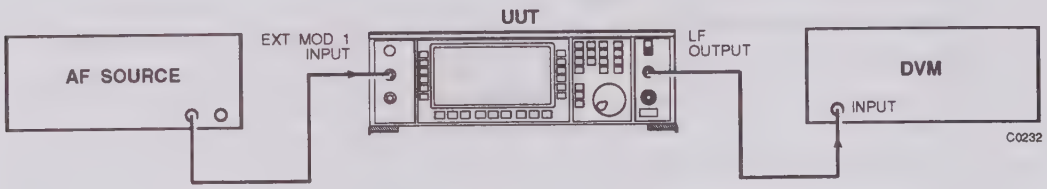

Fig. 5-2-2 Equipment configuration to measure the LF output level

(2) Measure the voltage at the UUT's LF OUTPUT socket on the DVM (and note it as V1).

The EXT 1 source calibration screen should be shown together with the reference calibration figure of 32768.

(3) On the UUT select the *[Next Source]* - EXT 1 ALC.

(4) Adjust the correction figure (using either the keyboard or the knob) until the signal at the LF OUTPUT socket is equal to V1 ±0.02 V.

(5) Connect the AF source to the UUT's EXT MOD 2 INPUT socket.

(6) Repeat steps (2) and (3) for the remaining sources (EXT 2, EXT 2 ALC, INT 1, INT 2) by selecting *[Next Source]*.

(7) When each of the sources has been calibrated, select *[Path Calib.]* and measure the LF output on the DVM (and note it as V1).

The AM 1 path calibration screen should be shown. This sets a reference calibration figure of 32768.

(8) On the UUT select the *[Next Path]* - AM 2.

(9) Adjust the correction figure (using either the keyboard or the knob) until the LF output is the same as V1.

(10) Repeat steps (2) and (3) for the remaining paths AM 2, FM 1 and FM 2.

(11) Select *[Next Path]*. Adjust the output for the LF path to 1 V RMS ±0.02 V.

(12) Save the calibration figures by using *[EXIT], [EXIT], [Save Calib.]*.

2 RF LEVEL CALIBRATION

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	AM accuracy ±1%	Marconi 2305
Digital volt-meter (DVM)	DC to 50 kHz	Solatron 7150+
Power meter and Sensor	300 kHz to 4.2 GHz	Marconi 6960A & 6912
Power meter and Sensor	10 MHz to 5.4 GHz	Marconi 6960A & 6910
Spectrum analyzer	Frequency to 1.35 GHz	Marconi 2383
DC source	-1.5 V DC	Marconi 2155

ADJUSTMENT

RF Level calibration

(a) **21 MHz to 1350 MHz** (2030, 2031 & 2032)

Process 0 - AM trough nulling
Process 1 - DC offset

Process 2 - RF level calibration 0 dBm and 10 dBm

Cal point 0 - 30 MHz	Cal point 5 - 750 MHz
Cal point 1 -150 MHz	Cal point 6 - 900 MHz
Cal point 2 -300 MHz	Cal point 7 -1050 MHz
Cal point 3 -450 MHz	Cal point 8 - 1200 MHz
Cal point 4 -600 MHz	Cal point 9 -1350 MHz

(b) **1350 MHz - 2700 MHz** (2031 & 2032 only)

Process 0 - AM trough nulling
Process 1 - DC offset

Process 2 - RF level calibration 0 dBm and 10 dBm

Cal point 0 - 1350 MHz	Cal point 5 - 2100 MHz
Cal point 1 - 1500 MHz	Cal point 6 - 2245 MHz
Cal point 2 - 1650 MHz	Cal point 7 - 2400 MHz
Cal point 3 - 1800 MHz	Cal point 8 - 2500 MHz
Cal point 4 - 1950 MHz	Cal point 9 - 2700 MHz

ADJUSTMENT (contd.)

c) **2700 MHz - 4050 MHz** (2032 only)

Process 0 - AM trough nulling
Process 1 - DC offset

Process 2 - RF level calibration 0 dBm and 10 dBm

Cal point 0 - 2700 MHz	Cal point 5 - 3450 MHz
Cal point 1 - 2850 MHz	Cal point 6 - 3600 MHz
Cal point 2 - 3000 MHz	Cal point 7 - 3750 MHz
Cal point 3 - 3150 MHz	Cal point 8 - 3900 MHz
Cal point 4 - 3300 MHz	Cal point 9 - 4050 MHz

(d) **4050 MHz - 5400 MHz** (2032 only)

Process 0 - AM trough nulling
Process 1 - DC offset

Process 2 - RF level calibration 0 dBm and 10 dBm

Cal point 0 - 4050 MHz	Cal point 5 - 4800 MHz
Cal point 1 - 4200 MHz	Cal point 6 - 4950 MHz
Cal point 2 - 4350 MHz	Cal point 7 - 5100 MHz
Cal point 3 - 4580 MHz	Cal point 8 - 5250 MHz
Cal point 4 - 4650 MHz	Cal point 9 - 5400 MHz

(e) **10 kHz - 21 MHz** (2030, 2031 & 2032)

Process 2 - RF level calibration 10 dBm

Cal point 0 - 10 kHz
Cal point 1 -100 kHz
Cal point 2 - 1 MHz
Cal point 3 - 10.546875 MHz
Cal point 4 - 15 MHz
Cal point 5 - 21.0937 MHz

21 MHz to 1350 MHz (2030, 2031 & 2032)

(1) **AM trough nulling** (Process 0) is performed as follows:

(a) Connect the DC source to the EXT MOD 1 INPUT on the UUT. Connect the RF OUTPUT on the UUT to the spectrum analyzer RF input. Equipment configuration is shown in Fig. 5-2-3.

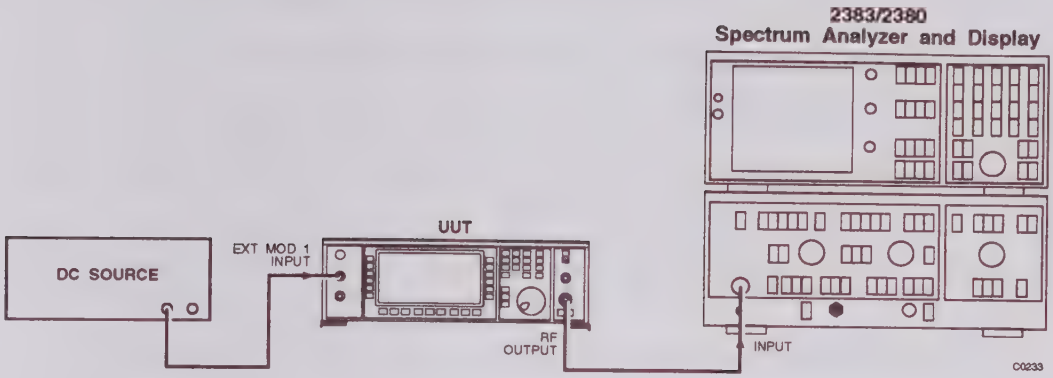

Fig. 5-2-3 Equipment configuration for AM trough nulling

(b) Set up the equipment as follows:

(i) Unlock the UUT to level 2 and select RF level cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [RF Level] [21 MHz - 1.35 GHz] [Start RF Cal]*

(ii) Tune the spectrum analyzer to 30 MHz, span 1 MHz.

(c) Apply -1.5 V ±0.08 V DC to the EXT MOD 1 INPUT.

(d) Adjust the correction figure until the carrier signal just reaches a minimum.

(e) Press *[Data Entry]* then *[Next Process]*.

(2) **AM DC offset** (Process 1) is performed as follows:

(a) Connect the RF OUTPUT on the UUT to the RF input on the modulation meter. Equipment configuration is shown in Fig. 5-2-4.

Fig. 5-2-4 Equipment configuration for AM DC offset

(b) Set up the modulation meter as follows:

Autotune
AM measurement
300 Hz to 3.4 kHz filter

(c) Select in turn 0 dB and 10 dB and adjust the correction figure until they give equal AM readings on the 2305.

(d) Press *[Data Entry]* then *[Next Process]*.

(3) **RF level check** is performed as follows:

(a) Connect a suitable power meter to the RF OUTPUT socket of the UUT.

(b) Adjust the correction figures so that the power meter reads 0 dBm ±0.01 dB.

(c) Select *[10 dB]*.

(d) Adjust the calibration figure so that the power meter reads 10 dBm ±0.01 dB.

(e) Select in turn 0 dBm and 10 dBm adjusting for correct RF power at both levels.

(f) Select *[Next Cal Point]*. Repeat steps (a) to (e) until the menu returns to cal point 0.

(g) Press *[EXIT]*, *[EXIT]* and *[Save Calib.]*

1350 MHz to 2700 MHz (2031 & 2032)

(1) **AM Trough Nulling** (Process 0) is performed as follows:

(a) Connect the DC source output to the EXT MOD 1 INPUT on the UUT. Connect the RF OUTPUT on the UUT to the spectrum analyzer RF input. Equipment configuration is shown in Fig. 5-2-5.

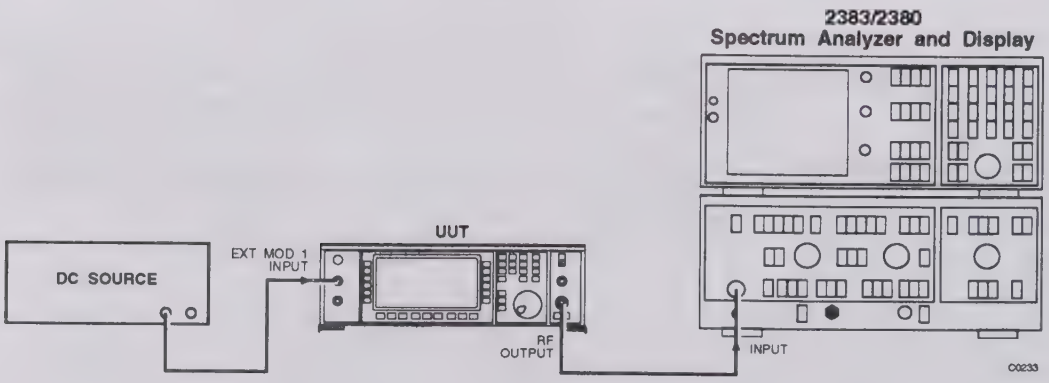

Fig. 5-2-5 Equipment configuration for AM trough nulling

(b) Set up the equipment as follows:

(i) Unlock the UUT to level 2 and select RF level cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [RF Level] [1.35 GHz - 2.7 GHz] [Start RF Cal]*

(ii) Tune the spectrum analyzer to 1.35 GHz, span 1 MHz.

(c) Apply -1.5 V ±0.08 V DC to the EXT MOD 1 INPUT.

(d) Adjust the correction figure until the carrier signal is at a minimum.

(e) Note the correction figure:-

AM trough nulling correction figure .....

(f) Press *[Data Entry]* then *[Next Process]*.

(2) **AM DC offset** (Process 1) is performed as follows:

(a) Connect the RF OUTPUT on the UUT to the RF input on the modulation meter. Equipment configuration is shown in Fig. 5-2-6.

Fig. 5-2-6 Equipment configuration for AM DC offset

(b) Set up the modulation meter as follows:

Autotune
AM Measurement
300 Hz to 3.4 kHz filter

(c) Select in turn 0 dB and 10 dB and adjust the correction figure until they both give equal AM readings on the 2305.

(d) Note the correction figure:-

AM DC offset correction figure .....

(e) Press *[Data Entry]* then *[Next Process]*.

(3) **RF level check** is performed as follows:

(a) Connect a suitable power meter to the RF OUTPUT of the UUT.

(b) Adjust the correction figure so that the power meter reads 0 dBm ±0.01 dB.

(c) Select *[10 dB].*

(d) Adjust the calibration figure so that the power meter reads 10 dBm ±0.01 dB.

(e) Select in turn 0 dBm and 10 dBm adjusting for correct RF power at both levels.

(f) Select *[Next Cal Point].* Repeat steps (a) to (e) until the menu returns to cal point 0.

(g) Select *[EXIT], [EXIT]* and *[Save Calib.].*

2700 MHz to 4005 MHz (2032 only)

(1) **AM Trough Nulling** (Process 0) is performed as follows:

(a) Set the correction figure to that recorded for the AM trough nulling in the 1350 to 2700 MHz calibration.

(2) **AM DC offset** (Process 1) is performed as follows:

(a) Set the correction figure to that recorded for the AM DC offset in the 1350 to 2700 MHz calibration.

(3) **RF level check** is performed as follows:

(a) Connect a suitable power meter to the RF OUTPUT of the UUT.

(b) Adjust the correction figure so that the power meter reads 0 dBm ±0.01 dB.

(c) Select *[10 dB].*

(d) Adjust the calibration figure so that the power meter reads 10 dBm ±0.01 dB.

(e) Select in turn 0 dBm and 10 dBm adjusting for correct RF power at both levels.

(f) Select *[Next Cal Point].* Repeat steps (a) to (e) until the menu returns to cal point 0.

(g) Select *[EXIT], [EXIT]* and *[Save Calib.].*

4005 MHz to 5400 MHz (2032 only)

(1) **AM Trough Nulling** (Process 0) is performed as follows:

(a) Set the correction figure to that recorded for the AM trough nulling in the 1350 to 2700 MHz calibration.

(2) **AM DC offset** (Process 1) is performed as follows:

(a) Set the correction figure to that recorded for the AM DC offset in the 1350 to 2700 MHz calibration.

(3) **RF level check** is performed as follows:

(a) Connect a suitable power meter to the RF OUTPUT of the UUT.

(b) Adjust the correction figure so that the power meter reads 0 dBm ±0.01 dB.

(c) Select *[10 dB].*

(d) Adjust the calibration figure so that the power meter reads 10 dBm ±0.01 dB.

(e) Select in turn 0 dBm and 10 dBm adjusting for correct RF power.

(f) Select *[Next Cal Point].* Repeat steps (a) to (e) until the menu returns to cal point 0.

(g) Select *[EXIT], [EXIT]* and *[Save Calib.].*

BFO Band 10 kHz to 21 MHz

(1) Unlock the instrument to level 2 and select RF level cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [RF Level] [BFO Band] [Start RF Cal]*

(2) **RF level check** is performed as follows:

(a) Connect a suitable power meter to the RF OUTPUT of the UUT.

Note...

It will be necessary to use the DVM and a 50 Ω load for the 10 kHz reading. Adjust the calibration figure until the DVM reads 0.7071 V ±1 mV.

(b) For each of the calibration points it is necessary to adjust the correction figures so that the power meter reads 10 dBm ±0.01 dB.

(c) Select *[Next Cal Point].* Repeat until the menu returns to cal point 0.

(d) Select *[EXIT], [EXIT]* and *[Save Calib.]*

3 MODULATION CALIBRATION

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	AM accuracy ±1% FM accuracy ±0.5% Carrier freq capability	Marconi 2305
Digital volt meter (DVM)		Solatron 7150+

ADJUSTMENT
Modulation calibration Frequency modulation Amplitude modulation Phase modulation Wide band FM Full calibration figure range: 0 to 65536 5% to 95% calibration figure range: 1638 to 63898

Frequency modulation calibration

(1) Connect the UUT rear panel SWEEP RAMP output via a T-connector to the DVM input and to the EXT MOD 1 INPUT on the UUT. Connect the RF OUTPUT on the UUT to the modulation meter RF input. Connect an external standard to the modulation meter. Equipment configuration is shown in Fig. 5-2-7.

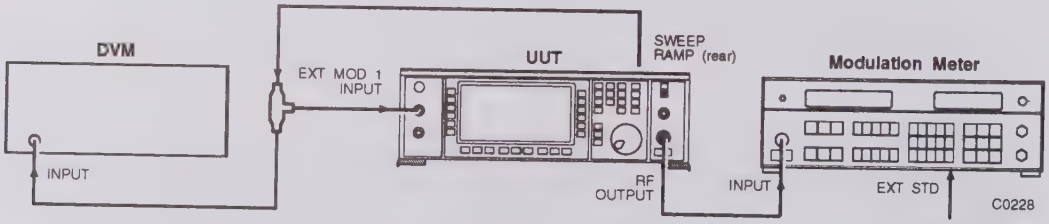

Fig. 5-2-7 Equipment configuration for the FM tests

(2) Set up the equipment as follows:

(a) Unlock the UUT to level 2 and select FM cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [Mod'n] [FM Calib.] [Select Mod Cal.]*

(b) Set the modulation meter as follows:-

Autotune
Carrier frequency
Carrier error

(c) Set the DVM as follows:-

DC measurement

(3) Press *[Cont FM Cal.]*.

(4) Measure the DC voltage at the EXT MOD 1 INPUT (and note as V0).

(5) Press *[Cont FM Cal.]*.

(6) Enter the voltage measured on the DVM into the UUT (V0).

(7) Press *[Cont FM Cal.]*.

(8) Enter the frequency error in kHz (minimum delta frequency 100 kHz, maximum 500 kHz). Press *[Cont FM Cal.]*. The new correction figure is calculated and displayed.

(9) Press *[EXIT]*. This returns to the modulation calibration menu. Press *[EXIT]* then *[Save Cal.]*. The main calibration menu is displayed.

(10) The FM self cal must be carried out for each VCO. Press *[FM self cal]*, select (VCO 0), (VCO 1,), (VC0 2) and (VCO 3) in sequence using the *[Select VCO]* and *[Start Calib.]* keys. (Each VCO takes about 1 minute to calibrate.)

(11) Press *[EXIT]*, *[EXIT]* and *[Save Calib.]*

Amplitude modulation calibration

(1) Connect the RF OUTPUT on the UUT to the RF input on the modulation meter. Equipment configuration is shown in Fig. 5-2-8.

Fig. 5-2-8 Equipment configuration for the AM tests

(2) Unlock the UUT to level 2 and select AM cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [Mod'n] [AM Calib.] [Select Mod Cal.]*

(3) Set up the modulation meter as follows:-

Autotune
AM measurement
300 Hz to 3.4 kHz filter

(4) In the AM calibration mode the UUT's output is set to about 600 MHz and AM is applied with a nominal 50% depth and a modulation frequency of 1 kHz. Adjust the calibration figure until the modulation depth measured on the modulation meter reads 50% ±0.15%.

Phase modulation calibration

(1) Connect the RF OUTPUT on the UUT to the RF input on the modulation meter. Connect an external standard to the modulation meter. Equipment configuration is shown in Fig. 5-2-9.

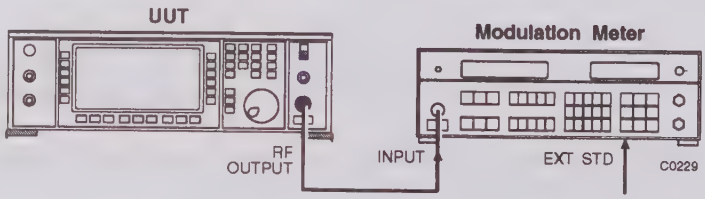

Fig. 5-2-9 Equipment configuration for the phase modulation tests

(2) Set up the equipment as follows:

(a) Unlock the UUT to level 2 and select phase mod cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [Mod'n] [Phase Calib.] [Select Mod Cal.]*

(b) Set the modulation meter as follows:

Autotune
FM measurement
300 Hz to 3.4 kHz filter
P-P/2

(3) Adjust the calibration figure until the deviation on the modulation meter is 5 kHz ±0.05 kHz. Press *[Exit].*

Wide band frequency modulation calibration

(1) Connect the AF source via a T-connector to the WIDE BAND FM IN on the UUT and to the DVM. Connect the RF OUTPUT on the UUT to the modulation meter. Equipment configuration is shown in Fig. 5-2-10.

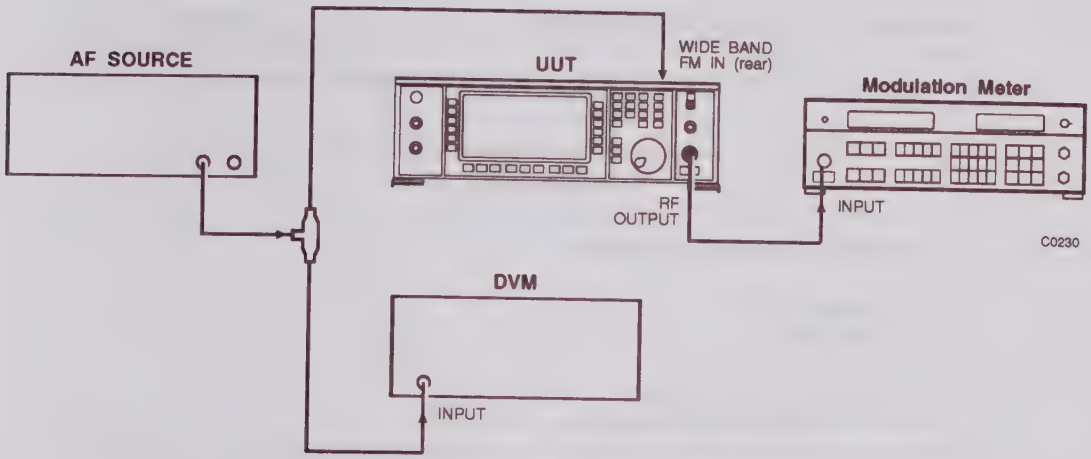

Fig. 5-2-10 Equipment configuration for the WBFM tests

(2) Set the AF source to 1 kHz and adjust the output level to 1 V RMS (and note as V1).

(3) Set up the equipment as follows:

(a) Unlock the UUT to level 2 and select WBFM cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [Mod'n] [WBFM Calib.] [Select Mod Cal.]*

(b) Set the modulation meter as follows:

Autotune
FM measurement
300 Hz to 3.4 kHz filter
P-P/2

(4) Set the AF source as follows:

1 kHz
1 V RMS

(5) Enter the voltage measured on the DVM. Press *[Cont WBFM cal.]*.

(6) Measure the deviation and enter the value in kHz (minimum 100 kHz, maximum 500 kHz). Press *[Cont WBFM cal]*.

(7) The new WBFM correction figure should be displayed. Press *[EXIT]*.

4 FREQUENCY STANDARD CALIBRATION

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	Carrier freq capability	Marconi 2305

ADJUSTMENT
Frequency standard calibration Coarse tune Fine tune Full calibration figure range: 0 to 255 5% to 95% calibration figure range: 13 to 243

(1) Connect the RF OUTPUT on the UUT to the RF input on the modulation meter. Connect an external standard to the modulation meter. Equipment configuration is shown in Fig. 5-2-11.

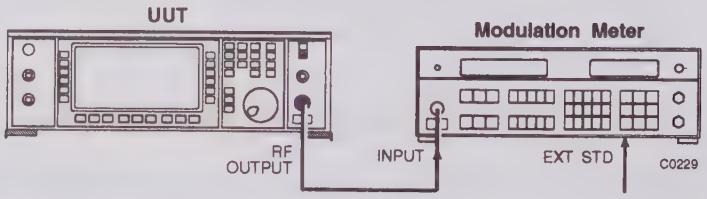

Fig. 5-2-11 Equipment configuration for the frequency standard

(2) Set up the equipment as follows:

(a) Set the frequency and level as follows:

[SIG GEN] *[Carrier Freq]* 1 GHz *[RF Level]* 0 dBm

(b) Unlock the instrument to level 2 and select freq std cal as follows:-

[UTIL] *[Utils. Menu 2] [Cal. Value] [Freq Std]*

(c) Set the modulation meter to the following:-

Auto tune
Carrier frequency

(3) Adjust the coarse frequency standard until the frequency measured on the modulation meter is 1000 MHz ±10 Hz.

(4) Adjust the fine tune until the modulation meter reads 1000 MHz ±1 Hz.

(5) Select *[EXIT], [EXIT]* then *[Save Calib].*

(6) Select *[Checks Complete]* and set *[Next Cal Date]* for 2 years time.

TABLE 5-2-1 CALIBRATION FORM

Calibration figures for Serial No. _____

(1) Source/Path calibration

	Source calibration		**Path calibration**
External 1	_____	AM 1	_____
External 1 ALC	_____	AM 2	_____
External 2	_____	FM 1	_____
External 2 ALC	_____	FM 2	_____
Internal 1 *001	_____	LF	_____
Internal 2 *001	_____		

(2) RF calibration

(a) **21 MHz to 1.35 GHz (2030, 2031 & 2032)**

AM trough _____
DC offset _____

RF level Cal point	0 dBm 6 dBm *003	10 dBm 16 dBm *003
0	_____	_____
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____

(b) **1.35 GHz to 2.7 GHz (2030 & 2031)**

AM trough _____
DC offset _____

RF level Cal point	0 dBm	10 dBm
0	_____	_____
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____

where * = Option no.

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TABLE 5-2-1 CALIBRATION FORM (contd.)

(c) **2.7 GHz to 4.050 GHz (2032 only)**

AM trough _____
DC offset _____

RF level Cal point	0 dBm	10 dBm
0	_____	_____
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____

(d) **4.050 GHz to 5.4 GHz (2032 only)**

AM trough _____
DC offset _____

RF level Cal point	0 dBm	10 dBm
0	_____	_____
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____

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TABLE 5-2-1 CALIBRATION FORM (contd.)

(e) 10 kHz to 21 MHz

RF level

Cal point	10 dBm 16 dBm *003
0	_____
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____

(3) Modulation calibration

AM	_____
FM1	_____
ΦM	_____
WBFM	_____
Pulse *003	_____

(4) Frequency standard calibration

Coarse	_____
Fine	_____

where * = Option no.

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Appendix A

ADJUSTMENT AND CALIBRATION
- +19 dBm HIGH POWER OPTION -

CONTENTS

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+19 dB HIGH POWER (Option 003)

The following calibration procedure is for a 2030 with the +19 dBm high power option fitted.

1 RF LEVEL CALIBRATION

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Modulation meter	AM accuracy ±1%	Marconi 2305
Digital volt-meter (DVM)	DC to 50 kHz	Solatron 7150+
Power meter and Sensor	300 kHz to 4.2 GHz	Marconi 6960A & 6912
Spectrum analyzer	Frequency to 1.35 GHz	Marconi 2383

ADJUSTMENT

RF Level calibration

(a) **21 MHz to 1350 MHz**

Process 0 - AM trough nulling
Process 1 - DC offset

Process 2 - RF level calibration 6 dBm and 16 dBm

Cal point 0 - 30 MHz	Cal point 5 - 750 MHz
Cal point 1 - 150 MHz	Cal point 6 - 900 MHz
Cal point 2 - 300 MHz	Cal point 7 - 1050 MHz
Cal point 3 - 450 MHz	Cal point 8 - 1200 MHz
Cal point 4 - 600 MHz	Cal point 9 - 1350 MHz

ADJUSTMENT (contd.)
(b) **10 kHz - 21 MHz** Process 2 - RF level calibration 16 dBm Cal point 0 - 10 kHz Cal point 1 - 100 kHz Cal point 2 - 1 MHz Cal point 3 - 10.546875 MHz Cal point 4 - 15 MHz Cal point 5 - 21.0937 MHz

21 MHz to 1350 MHz

(1) **AM trough nulling** (Process 0) is performed as follows:

(a) Connect the DC source to the EXT MOD 1 INPUT socket on the UUT. Connect the RF OUTPUT socket on the UUT to the spectrum analyzer RF input. Equipment configuration is shown in Fig. A-1.

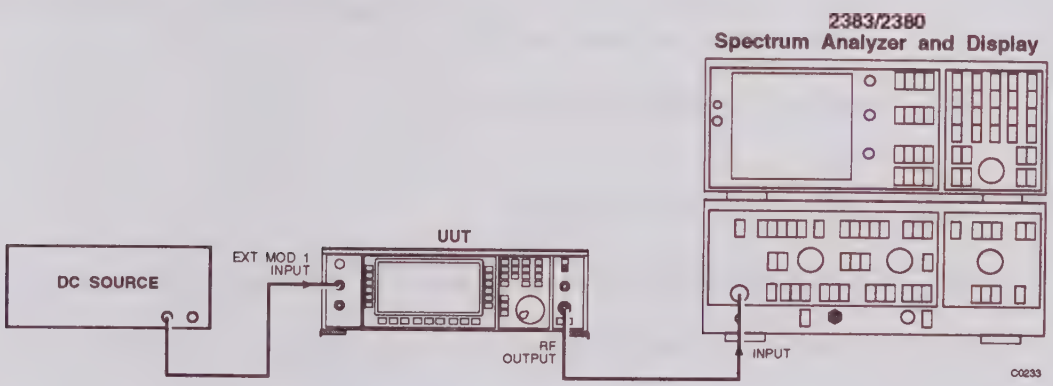

Fig. A-1 Equipment configuration for AM trough nulling

(b) Set up the equipment as follows:

(i) Unlock the UUT to level 2 and select RF level cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [RF Level] [21 MHz - 1.35 GHz] [Start RF Cal]*

(ii) Tune the spectrum analyzer to 30 MHz, span 1 MHz.

(c) Apply -1.5 V ±0.08 V DC to the EXT MOD 1 INPUT.

(d) Adjust the correction figure until the carrier signal just reaches a minimum.

(e) Press *[Data Entry]* then *[Next Process]*.

(2) **AM DC offset** (Process 1) is performed as follows:

(a) Connect the RF OUTPUT socket on the UUT to the modulation meter RF input. Equipment configuration is shown in Fig. A-2.

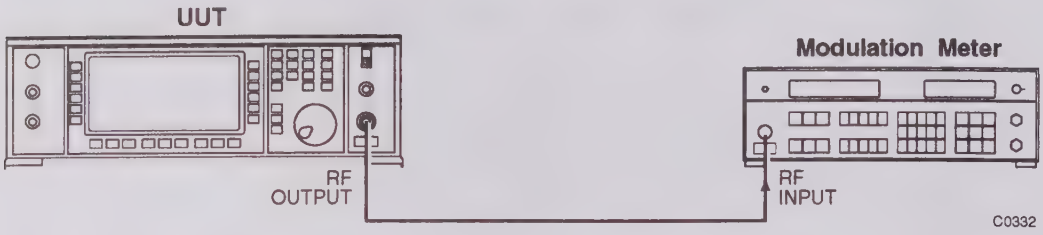

Fig. A-2 Equipment configuration for AM DC offset

(b) Set up the modulation meter as follows:

Autotune
AM measurement
300 Hz to 3.4 kHz filter

(c) Select in turn 6 dBm and 16 dBm and adjust the correction figure until they both give equal AM readings on the 2305.

(d) Press *[Data Entry]* then *[Next Process].*

(3) **RF level check** is performed as follows:

(a) Connect the power meter to the RF OUTPUT socket of the UUT.

(b) Adjust the correction figure so that the power meter reads 6 dBm ±0.01 dB.

(c) Select *[16 dBm].*

(d) Adjust the calibration figure so that the power meter reads 16 dBm ±0.01 dB.

(e) Select in turn 6 dBm and 16 dBm adjusting for correct RF power.

(f) Select *[Next Cal Point].* Repeat until the menu returns to cal point 0.

(g) Press *[EXIT], [EXIT]* and *[Save Calib.]*

BFO band 10 kHz to 21 MHz

(1) Unlock the instrument to level 2 and select RF level cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [RF Level] [BFO Band] [Start RF Cal]*

(2) **RF level check** is performed as follows:

(a) Connect the power meter to the RF OUTPUT socket of the UUT.

Note...

It will be necessary to use the DVM and a 50 Ω load for the 10 kHz reading. Adjust the calibration figure until the DVM reads 0.7071 V ±1 mV.

(b) For each of the calibration points it is necessary to adjust the correction figures so that the power meter reads 16 dBm ±0.01 dB.

(c) Select *[Next Cal Point]*. Repeat until the menu returns to cal point 0.

(d) Select *[EXIT]*, *[EXIT]* and *[Save Calib.]*

TABLE A-1 CALIBRATION FORM

Calibration figures for Serial No. _____

(1) RF calibration

(a) **21 MHz to 1.35 GHz**

AM trough _____
DC offset _____

RF level Cal point	6 dBm	16 dBm
0	_____	_____
1	_____	_____
2	_____	_____
3	_____	_____
4	_____	_____
5	_____	_____
6	_____	_____
7	_____	_____
8	_____	_____
9	_____	_____

(b) **10 kHz to 21 MHz**

RF level Cal point	16 dBm
0	_____
1	_____
2	_____
3	_____
4	_____
5	_____

Blank page

Appendix B

ADJUSTMENT AND CALIBRATION - PULSE MODULATION OPTION -

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1 PULSE MODULATION CALIBRATION ..... App. B-2
Calibration ..... App. B-2

LIST OF FIGURES

Fig. B-1 Equipment configuration for pulse modulation calibration ..... App. B-2

PULSE MODULATION (Option 002)

The following calibration procedure is for an instrument with the pulse modulation option fitted.

1 PULSE MODULATION CALIBRATION

TEST EQUIPMENT		
Description	**Minimum specification**	**Example**
Power meter	300 kHz to 4.2 GHz	Marconi 6960A and 6912

ADJUSTMENT
Pulse modulation calibration Relative RF level adjustment between pulse modulation disabled and pulse modulation enabled.

Calibration

(1) Connect the RF OUTPUT socket on the UUT to the sensor input. Connect the sensor output to the power meter input. Equipment configuration is shown in Fig. B-1.

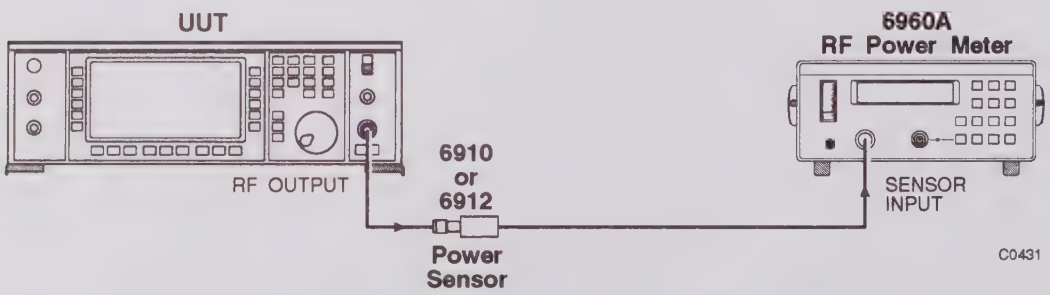

Fig. B-1 Equipment configuration for pulse modulation calibration

(2) Set up the equipment as follows:

(a) Unlock the UUT to level 2 and select pulse mod cal as follows:

[UTIL] *[Utils. Menu 2] [Cal. Value] [Mod'n] [Pulse Mod. Cal.] [Select Mod. Cal.]*

(3) Measure the RF level on the power meter (and note as L1). This should be nominally 0 dBm.

(4) Press *[Continue Calib.]*

(5) Adjust the correction figure until the RF OUTPUT equals L1 as measured in step (3) above.

(6) Press *[EXIT]*, *[EXIT]* and *[Save Calib.]*.

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Chapter 5-3
FAULT DIAGNOSIS

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GENERAL PROCEDURE

If an error message is displayed, first of all check for additional information in Tables 5-3-1 and 5-3-2. Then, or if a fault is otherwise suspected, go to the top level Fault Symptom Key Chart. This will indicate, by reference to the symptoms, which function is suspect. This will lead you to one or more lower level flow charts which will enable the fault to be located in a relatively small group of components or functional area. Note that where board AA1 is mentioned, it applies to all versions.

For a complete understanding of the fault you should read the relevant part of the Technical Description in Chap. 4-2 in conjunction with the Servicing Diagrams in Chap. 7.

A further guide to detailed fault location is provided by the component layout drawings shown opposite the circuit diagrams in Chap. 7.

Note that performance limits quoted in this chapter are for guidance only and should not be taken as guaranteed performance specifications unless they also appear in the Performance Data in Chap. 1 of the Operating Manual.

FUSE REPLACEMENT

Either one or two cartridge-types fuses are located on the signal generator rear panel. These main supply fuses are double time lag, 1.6 A for 90 to 123 V AC and 1 A for 188 to 242 V AC. Always switch off the power supply when replacing a fuse.

ERROR MESSAGES ON 2030 SERIES INSTRUMENTS

Hints on methods of rectifying faults in response to displayed error messages are given in Tables 5-3-1 and 5-3-2.

Note that the instrument will not power up on detecting one of the fatal errors shown in Table 5-3-2.

TABLE 5-3-1 BACKGROUND ERROR MESSAGES

No.	Message	Helpful hint
1	RPP Tripped	Remove reverse power and press *[reset]* key.
2	Fractional N Out of Lock	VCO tune volts are outside normal range of operation, indicating that synthesizer is faulty. Refer to fault finding flowchart for Frequency Error Fault.
3	Int. Standard Failure	No standard signal passing to VCXO phase comparator. Check connector PLAP is fitted and trace standard signal through to TR501. If no 10 MHz on connector, check power to AR2 (note that oscillator power is switched on AR1).
4	Ext. Standard Failure	As for int. Check signal voltage is 2 V pk-pk on ext. standard. Check operation with int. standard selected.
5	Incorrect Ext. Standard	Check ext. standard frequency. Check no errors using int. standard before tracing signal from PLAP to output IC514.
6	VCXO Out of Lock	104.8576 MHz VCXO tune volts is outside normal range. Check that output on flying lead to PLAL is adjusted for maximum using C604. Trace operation of reference loop on AA1.
24	FM Selfcal Error	During the FM selfcal an extreme correction number was required. Check frequency synthesis on VCO in question and deal with frequency errors. Look at FM path if frequency OK.
26	Real Time Clock Problem	Either power for clock was interrupted or processor cannot talk to clock. Reset time and, if required, date; if cannot, check battery connected and battery voltage. Check operation of Real Time Clock on AR1.
27	Calibration Date Expired	First check that time and date are correct, then recalibrate as detailed in Chap. 5-2.

continued/...

TABLE 5-3-1 BACKGROUND ERROR MESSAGES (contd.)

No.	Message	Helpful hint
28	Pad Calibration Checksum	Calibration numbers for attenuator stored on EAROM on attenuator assembly AT10 require recalibration. Recalibrate as detailed in Chap. 5-2.
29 30 31 32 33	RF Calibration Checksum FM Calibration Checksum Path/Source Calibration Absolute Mod. Calibration Freq. Std. Calibration	Data in EAROMs corrupted and requires recalibration. If *[Continue]* pressed, instrument will operate but parameters covered by checksum in question will not be calibrated.

TABLE 5-3-2 FATAL ERROR MESSAGES

No.	Message	Helpful hint
171 172	Main RAM Faulty Main PROM Faulty	Ensure device is correctly fitted. Try another chip, then check address decoding and data bus on AA1.
173	Microwave Board Error	Cannot read back a recognised board type. Check data bus working.
174	Attenuator Type Unknown	Does not read back correct attenuator type. Switch off, disconnect attenuator and power up again to see if nibble bus or attenuator module is at fault.

FAULT FINDING FLOW CHARTS

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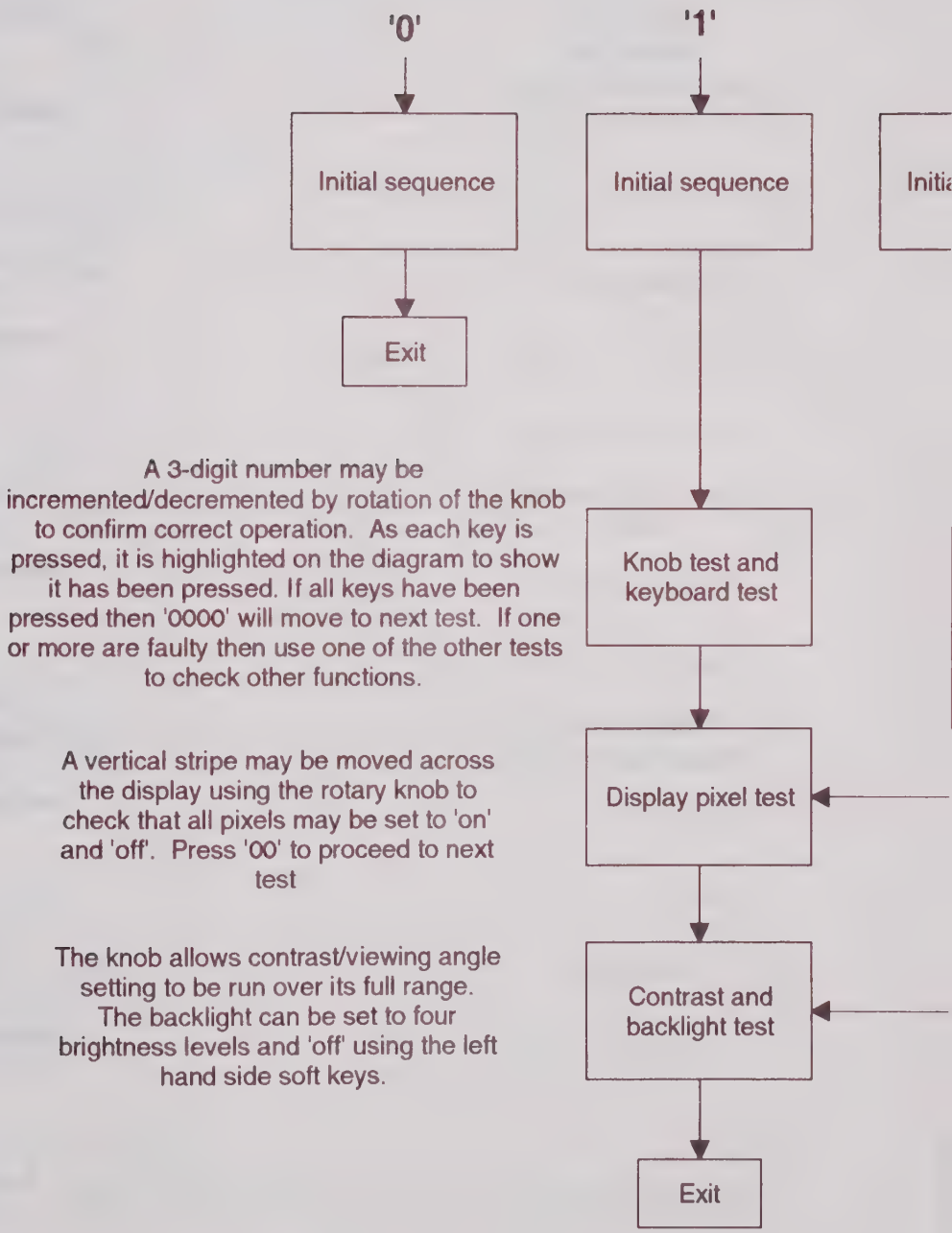
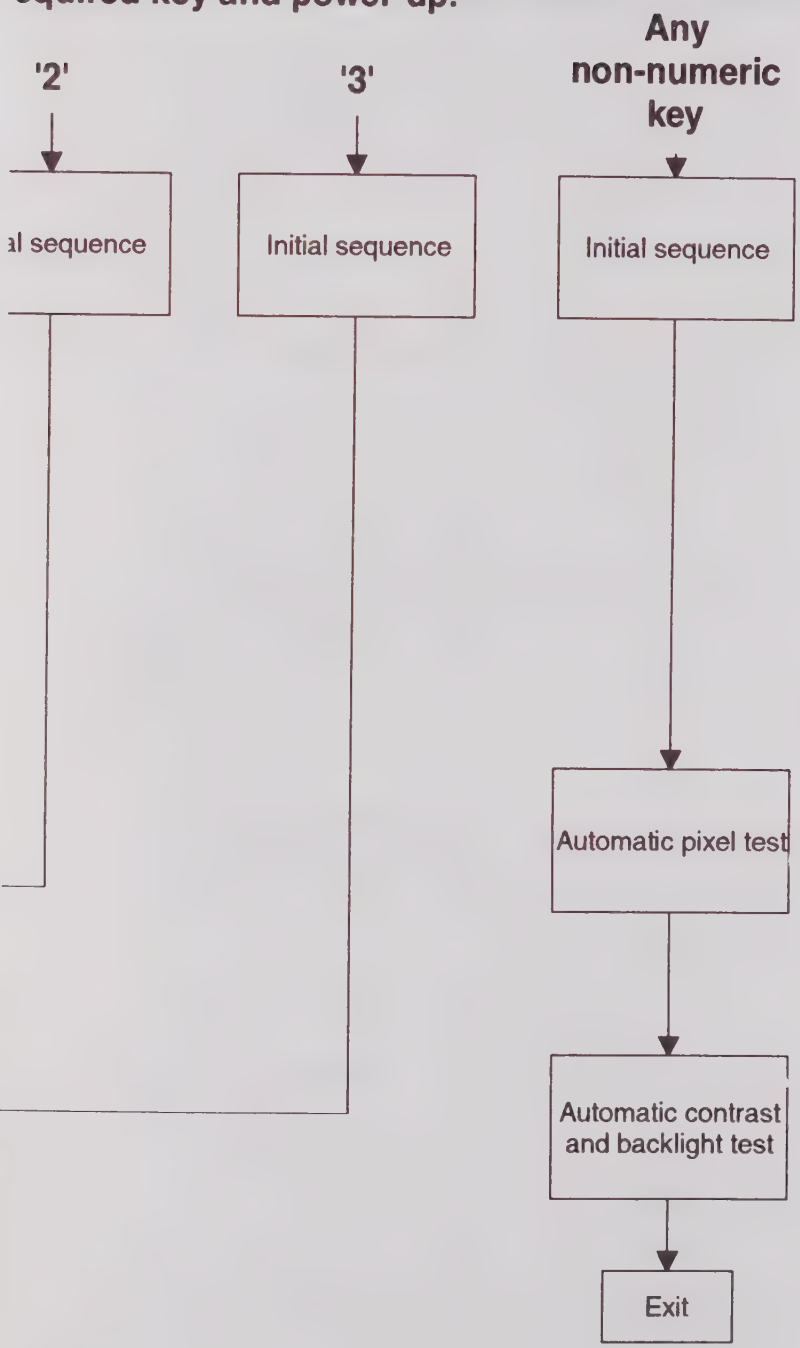
Hold down r


'0'
'1'
Initial sequence
Initial sequence
Initia
Exit
A 3-digit number may be incremented/decremented by rotation of the knob to confirm correct operation. As each key is pressed, it is highlighted on the diagram to show it has been pressed. If all keys have been pressed then '0000' will move to next test. If one or more are faulty then use one of the other tests to check other functions.
Knob test and keyboard test
A vertical stripe may be moved across the display using the rotary knob to check that all pixels may be set to 'on' and 'off'. Press '00' to proceed to next test
Display pixel test
The knob allows contrast/viewing angle setting to be run over its full range. The backlight can be set to four brightness levels and 'off' using the left hand side soft keys.
Contrast and backlight test
Exit

Front Panel Processor Tests
(use in conjunction with next page)

equired key and power-up.



Notes

For all of the initial sequences the contrast is set to a nominal value and the backlight turned on. The screen is cleared and then a "walking man" appears.

In auto mode the bar does one screen and then moves onto the next test.

In auto mode the brightness is cycled through its four poosssible levels several times.

LCD or Power Up Fault (Level 2)

46881-978M
Oct. 91

Level Error Fault (Level 2)

46881-978M
Oct. 91

Frequency Error Fault (Level 2)

46881-978M
Oct. 91

Freq Mod or Phase Mod Fault (Level 2)

46881-978M
Oct. 91

AM Fault (Level 2)

46881-978M
Oct. 91

Pulse Modulation Fault (Level 2)

46881-978M
Oct. 91

Power Supply Unit Fault (Level 3)

46881-978M
Oct. 91

Beat Frequency Oscillator Fault (Level 3)

46881-978M
Oct. 91

Frequency Doubler Board Fault [AB3/5] (Level 3)

A synthesizer fault is where the output frequency measured by a counter using the same frequency standard indicates that the output frequency differs from the set value.

Synthesizer: Errors within the synthesizer require breaking the loop to trace the error. Break the loop by disconnecting PLAE, the RF input to the synthesizer, and connecting an external synthesizer covering the fundamental range of the sig gen (675 MHz - 1350 MHz). Set external synthesizer to a nominal 2 dBm.

Note 1

Set the instrument to a carrier frequency in the fundamental range with the modulation disabled. Monitor the voltage on cathode D406 (tune volts) and the waveform on TP5 (phase comparator output). Set the external synthesizer to the set frequency plus 10 MHz and minus 10 MHz and check for the following:

Frequency	TP5 waveform	D406 Voltage
f + 10 MHz	mainly high	approx. 1 V
f - 10 MHz	mainly low	>20 V

The points should monitor the same with FM enabled but off. If the waveform at TP5 is incorrect check the operation of the programmable divider and its control lines. If TP5 is correct but the tune volts are not, look at the current sources (AA1 sheets 4 & 7).

Synthesizer Fault (Level 3)

46881-978M
Oct. 91

LF Switch Matrix Fault (Level 3)

46881-978M
Oct. 91

RESIDUAL FM PROBLEMS

Residual FM problems are due to the spurious modulation of the VCOs on AB1. These VCOs are very sensitive with a varactor diode sensitivity of about 20 MHz/V, hence very low level signals may give rise to spurious modulation of the carrier frequency.

If the fault only arises on one of the VCOs on AB1, the fault can be located on that VCO on AB1. Monitoring the LF output using a modulation monitor (e.g. a Marconi Instrument's 2305) with a loudspeaker output will help locate faulty components within the oscillator.

If the residual FM only occurs when FM is enabled (even if off), the current sources on AA1 should be checked along with the bandwidth selection on AB2 (refer to the fault finding flow chart for Frequency Error Fault).

Residual FM which is dependant on the deviation set implies a fault either in the analogue path (check the FM drive and the FM signal passed to AB2), or the digital path (check the 1-bit ADC and synthesizer control lines).

Instability in the synthesizer loop may give rise to coherent spurious modulation. Monitoring the TUNE line for coherent signals will detect this. This form of residual FM may give rise to large excursions while the average frequency is maintained at that requested. Similar residual FM arises if the programmable divider control lines are not all operating correctly (refer to the fault finding flow chart for Frequency Error Fault).

LATCH DATA UTILITY

The Latch Data Utility provides a means of inspecting the data that has been sent to the various latches within the instrument and allows the user to send alternative data to specified latches. This is primarily intended as a diagnostic aid to assist in fault identification.

Operation

Operation is as follows:

Press **[UTIL]** , *[Utils Menu 2]*. Press *[Latch Data]* to bring up the Latch Data Menu.

[Restore On/Off] selects Restoring or Non-Restoring Mode. Restoring/Non-Restoring Status is displayed on the upper right of the menu screen.

In Restoring mode latches whose values have been changed by the user are restored to their previous value when ANY latch is updated outside the utility (i.e. by changing any parameter). This allows the user to select for example the Sig Gen menu to inspect the settings and return to the Latch Data utility without restoring, but ensures that the instrument will operate in the correct manner after using this utility.

In Non-Restoring mode the modified latch will not be restored until that particular latch requires updating because of a changed parameter. The user should be aware that changing a parameter may affect latches associated with other functions, in particular changing the carrier

frequency is likely to update latches associated with modulation and RF level as well as the ones associated with frequency.

[Latch Number] is a function to specify the index number of the latch to be inspected or set. Press numeric keys and terminate with *[Enter]*. Information about the selected latch is displayed on the screen, this includes the board designation, the IC designation and a brief description of the function of the latch e.g. Latch 0 - *AA1/2 IC402 12 bit FM CH1 DAC (low byte)*. Latch numbers are indicated in a box adjacent to the appropriate IC on the circuit diagrams.

[1,2,3,5 Latches] allows groups of consecutive latches to be treated as a single number. The 2 latches setting is useful for the various 12-bit DACS, the 3 latches setting for the 24-bit numbers used for the modulation oscillators and the 5 latches setting for the 40-bit numbers used in the fractional-N controller. Each press of this key advances the selection in the sequence 1-2-3-5-1... Information about the selected number of latches (starting at the chosen Latch Number) is displayed.

[Decimal/Binary] selects whether latch data is displayed or entered in decimal or binary format. Binary is only available when the number of latches selected is 1 or 2.

In Decimal Mode:-

[Latch Data] is a function key that allows decimal data to be written to the selected latch or latches. When this key is highlighted the user may enter a number in the ranges 0 to 255, 0 to 65535, 0 to 16777215 or 0 to 1099511627775 (for 1, 2, 3 or 5 latches) terminated with *[Enter]*, at which time the data is written to the latch.

In Binary Mode:-

[Cursor Left], [Cursor Right] moves the cursor (underscore) left or right along the 8 or 16 displayed bits.

[Toggle Bit] changes the state of the bit at the cursor from 1 to 0, or 0 to 1, the new 8- or 16-bit value is written to the latch/latches immediately.

[Next Latch], [Previous Latch] increments/decrements the Latch Number by 1, 2, 3 or 5 (as selected by *[1,2,3,5 Latches]*).

A list of hardware latches is given in Table 5-3-3.

Notes...

Certain latches are read-only, this is usually obvious from the latch description. If this is the case entered data has no effect and the old value is redisplayed.

Changes to the GPIB write latches (112 to 119) can only be restored by switching the instrument Off and On again, so should be used with caution.

The Nibble Bus Protocol Latch (111) is always restored.

TABLE 5-3-3 HARDWARE LATCHES

Latch	Board	IC	Bits	Description
00	AA1	IC402	12	FM CH1 DAC (low byte)
01	AA1	IC402	12	FM CH1 DAC (high nibble)
02	AA1	IC402	12	FM CH2 DAC (low byte)
03	AA1	IC402	12	FM CH1 DAC (high nibble)
04	AA1	IC319	12	SWEEP DAC (low byte)
05	AA1	IC319	12	SWEEP DAC (high nibble)
06	AA1	IC319	12	AUDIO DAC (low byte)
07	AA1	IC319	12	AUDIO DAC (high nibble)
08	AA1	IC507	8	FREQ. STD. FINE DAC
09	AA1	IC507	8	FREQ. STD. COARSE DAC
10	AA1	IC507	8	LAW CORR DAC (AM TROUGHS)
11	AA1	IC507	8	LAW CORR DAC (DC OFFSETS)
12	AA1	IC502	12	AM CH1 DAC (low byte)
13	AA1	IC502	12	AM CH1 DAC (high nibble)
14	AA1	IC502	12	AM CH2 DAC (low byte)
15	AA1	IC502	12	AM CH1 DAC (high nibble)
16	AA1	IC505	12	RFLEVEL DAC (low byte)
17	AA1	IC505	12	RFLEVEL DAC (high nibble)
18	AA1	IC505	12	DIR AIM DAC (low byte)
19	AA1	IC505	12	AIM DAC (high nibble)
20	RESERVED FOR FUTURE USE			
21	RESERVED FOR FUTURE USE			
22	RESERVED FOR FUTURE USE			
23	AA1	IC509	8	Auxiliary control latch
24	AA1	IC412	8	FM controlling latch
25	AB2	IC009	8	RF controlling latch
26	AB2	IC007	8	RF controlling latch
27	AA1	IC303	8	AM controlling latch
28	AA1	IC302	8	FM controlling latch
29	AA1	IC304	8	AF controlling latch
30	AA1	IC510	8	Misc. controlling latch

GPIB Operation

The following commands are used for the Latch Data Utility:

PORT

:ADDR Set Latch Number

Data type: Decimal Numeric Program Data

Suffix: None

:ONE Write 1 byte data to selected Latch - N

:TWO Write 2 bytes to Selected Latches N, N+1

:THREE Write 3 bytes to Selected Latches N,

FIVE Write 5 bytes to Selected Latches N...N+4

Data type: Decimal Numeric Program Data

Suffix: None

Examples:

```
PORT:ADDR 8;ONE 17
PORT:FIVE 1.2e10
```

PORT

:ONE?
:TWO?
:THREE?
:FIVE?

Prepares message containing information on Latch data in the format:

:PORT:ADDR <nr1>;<latches> <nr1>
where: <latches> is ONE or TWO or THREE or FIVE

Examples:

```
PORT:TWO?
:PORT:ADDR 24;TWO 3147
```

Chapter 6
REPLACEABLE PARTS

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INTRODUCTION

Each sub-assembly or printed circuit board in this equipment has been allocated a reference designator code, e.g. A0, A1, A2 etc.

The complete component reference includes its reference designator as a prefix e.g. A2C1 (capacitor C1 on sub-assembly A2) but for convenience in the text and diagrams, the prefix is omitted unless it is needed to avoid confusion. However, when ordering replacements or in correspondence, the complete component reference should be quoted.

PARTS LISTS

The replaceable parts lists for the 2030 series of signal generators are arranged in the following order:

(a) A top level parts list, A1, showing parts common to all instruments in the series.

(b) Three lists of parts, A2, used to make the three different versions of the instrument, i.e. the 2030, 2031 and 2032.

(c) Lists of parts, A3 to A6, providing the various options, e.g A3 is the 2nd modulation oscillator option.

(d) Lists of components used on individual boards AA1/2 onwards in alphanumerical order.

BOARDS AND UNITS

To find out which boards and units are fitted in your instrument refer to Fig. 6-1 which shows the various versions and options for the 2030 Signal Generator series.

COMPONENT VALUES

One or more of the components fitted in the equipment may differ from those listed in this chapter for any of the following reasons:

(a) Components indicated by an * (or SIC) have their values selected during test to achieve particular performance limits.

(b) Owing to supply difficulties, components of different value or type may be substituted provided the overall performance of the equipment is maintained.

(c) As part of a policy of continuous development, components may be changed in value or type to obtain detail improvements in performance.

When there is a difference between the component fitted and the one listed, always use as a replacement the same type and value as found in the equipment.

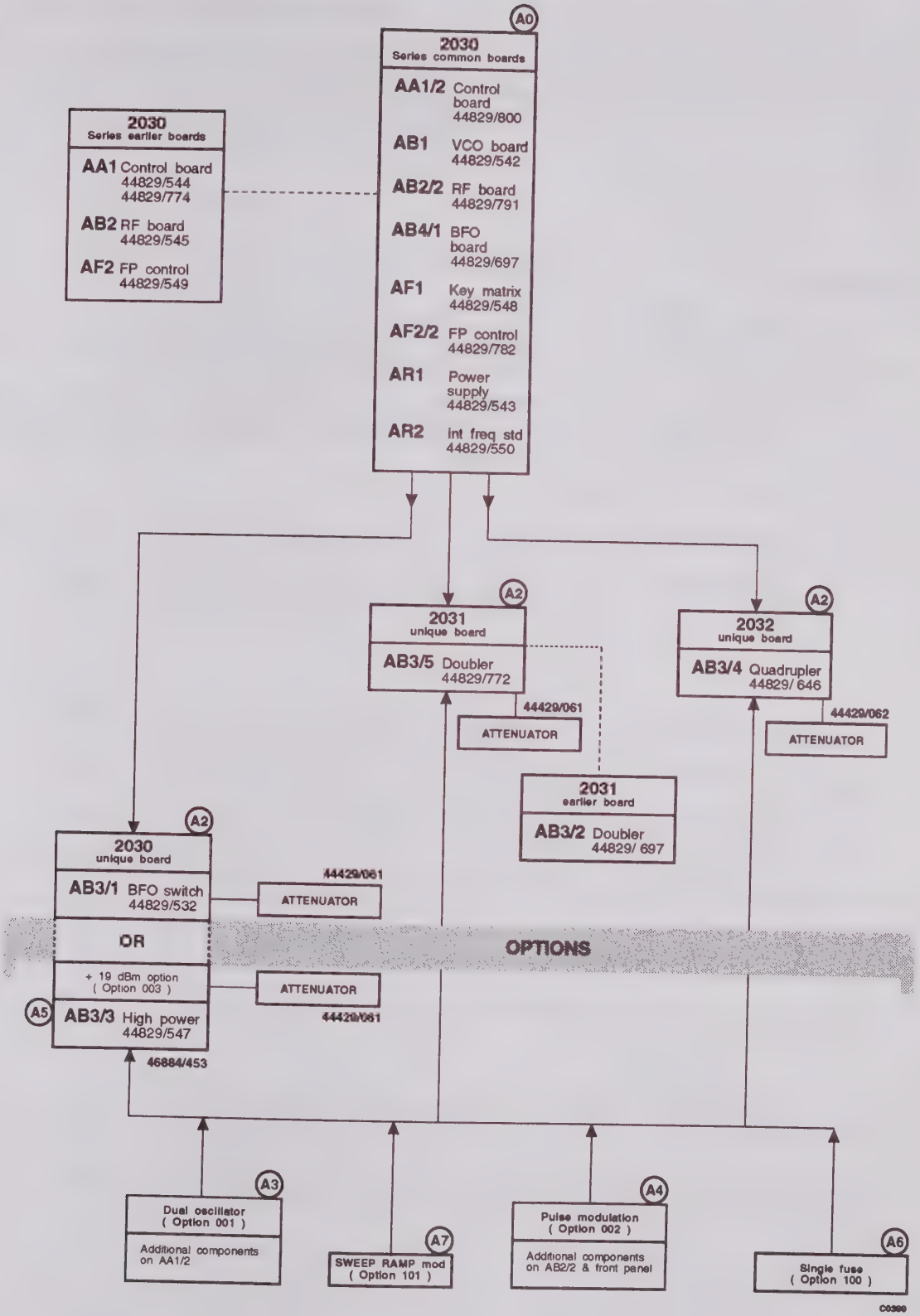

Fig. 6-1 Boards and units fitted to the 2030 series Signal Generators

The Component List includes information about one source of manufacture for each part along with that manufacturer's part number. Sources other than those listed may have been used to supply parts used in your equipment. Alternative replacement devices can often be obtained from other manufacturers but the user must satisfy himself that the items are equivalent in all significant parameters before fitting to the equipment. Where the manufacturer is listed as Marconi Instruments, the part can only be obtained from our Service Division or your nearest Agent.

ORDERING

When ordering replacements, address the order to our Service Division (address at rear of manual) or nearest agent and specify the following for each component required:-

(1) Type and serial number of equipment, as given on the serial number label at the rear of the equipment. If this is superseded by a model number label, quote the model number instead of the type number.

(2) Complete circuit reference.

(3) Description.

(4) Part number.

ELECTRICAL COMPONENTS

A1 2030 series common parts

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When ordering, prefix circuit reference with A1.
Refer to Fig. 7-1, 2031 interconnections.

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C31	26373/714	CAPACITOR FIXED CERAMIC 1nF -20/+80% 500V K2600 FEED-THROUGH, SCREW-IN MOUNTING, 2BA THREAD WITH	MIDLAND CAPACITORS	361/K2600-1000pF
C32	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
C33	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
C34	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
D1	28359/191	DIODE RECTIFIER, BY261-200... BRIDGE, 200V 25A 2.3Vf @ 12A, ENCAPSULATED, 29mm SQUARE.	INTERNAT RECTIFIER	26MB20A
D2	28359/191	DIODE RECTIFIER, BY261-200... BRIDGE, 200V 25A 2.3Vf @ 12A, ENCAPSULATED, 29mm SQUARE.	INTERNAT RECTIFIER	26MB20A
PLAF	23444/302	CONNECTOR-RF ADAPTOR 50 OHMS, SMB MALE TO MALE, BULKHEAD, GOLD OR NICKEL PLATED BODY.	SUHNER ELECTRONICS	34SMB-50-0-2
PLAL	23444/331	CONNECTOR-RF SMB-TYPE MALE, RECEPTACLE, 50 OHMS, BULKHEAD, SOLDER-BUCKET, FRONT MOUNTING, NICKEL	GREENPAR (DUBILIER)	B65M19J999X02
PLXH	23444/331	CONNECTOR-RF SMB-TYPE MALE, RECEPTACLE, 50 OHMS, BULKHEAD, SOLDER-BUCKET, FRONT MOUNTING, NICKEL	GREENPAR (DUBILIER)	B65M19J999X02
PLXJ	23444/512	CONNECTOR-RF SMA-TYPE FEMALE, JACK, 50 OHMS, BULKHEAD, SOLDER-BUCKET, REAR MOUNTING, STAINLESS	OMNI SPECTRA LTD	2058-0000-02
R1	24773/201	RESISTOR FIXED METAL-FILM 1R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	PHILIPS	ES-SFR25-1R-2
SKXK	23443/406	CONNECTOR-RF BNC-TYPE FEMALE, RECEPTACLE, 50 OHMS, FLANGED, SOLDER-BUCKET, 17.5mm SQUARE FLANGE WITH **MARKER**	GREENPAR (DUBILIER)	B35K07H999H02
SKXL	23443/406	CONNECTOR-RF BNC-TYPE FEMALE, RECEPTACLE, 50 OHMS, FLANGED, SOLDER-BUCKET, 17.5mm SQUARE FLANGE WITH **RAMP**	GREENPAR (DUBILIER)	B35K07H999H02

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
A1	**2030 series common parts (contd.)**			
SKXM	23443/406	CONNECTOR-RF BNC-TYPE FEMALE, RECEPTACLE, 50 OHMS, FLANGED, SOLDER-BUCKET, 17.5mm SQUARE FLANGE WITH **TRIGGER**	GREENPAR (DUBILIER)	B35K07H999H02
SKXP	23443/406	CONNECTOR-RF BNC-TYPE FEMALE, RECEPTACLE, 50 OHMS, FLANGED, SOLDER-BUCKET, 17.5mm SQUARE FLANGE WITH **FREQ STD IN/OUT**	GREENPAR (DUBILIER)	B35K07H999H02
	23423/171	CONNECTOR MAINS, PLUG, 3 WAY, RF FILTER, DUAL (REPLACED BY 23423/174 WHEN OPTION 100 FITTED)	SCHAFFNER EMC LTD	FN378-6/21
	23443/442	CONNECTOR-RF BNC-TYPE FEMALE, RECEPTACLE, 50 OHMS, **EXT MOD INPUT**	GREENPAR (DUBILIER)	B35M53H999X02
	23443/449	CONNECTOR-RF BNC-TYPE FEMALE, RECEPTACLE, 50 OHMS, **LF OUTPUT**	AMPHENOL LTD	31-10
	43137/303	WIRE-LEAD-CRIMPED 4 WIRE, 7/0.2mm, CRIMP HOUSING 5 SHAFT ENCODER TO PLFL, AF2/X	MARCONI INSTRUMENTS LTD	
	43137/305	WIRE-LEAD-CRIMPED 5 WIRE, 7/0.2mm, CRIMP HOUSING PLRL, AR2 TO PLRK, AR1	MARCONI INSTRUMENTS LTD	
	43137/340	RF-CABLE FLEXIBLE RG178B/U, 50 OHMS, SMB FEMALE FLYING LEAD FROM PLBA, AB1	MARCONI INSTRUMENTS LTD	
	43137/345	WIRE-LEAD-CRIMPED 5 WIRE, 7/0.2mm, CRIMP HOUSING 9 PLAP, AA1/X TO VARIOUS	MARCONI INSTRUMENTS LTD	
	43137/348	RF-CABLE FLEXIBLE RG178B/U, 50 OHMS, BNC FEMALE WIDE BAND FM IN, SKXN TO PLAR, AA1/X	MARCONI INSTRUMENTS LTD	
	43137/375	WIRE-LEAD-CRIMPED 9 WIRE, 7 & 16/0.2mm, CRIMP PLRD, AR1 TO PLAA, AA1/X	MARCONI INSTRUMENTS LTD	
	43137/377	RF-CABLE FLEXIBLE RG178B/U, 50 OHMS, SMB FEMALE SKRM, AR2 TO SKXH, AA1/X	MARCONI INSTRUMENTS LTD	
	43137/379	RIBBON-LEAD 10 WAY, SOCKET 10 WAY, - SOCKET 10 PLFJ, AF2/X TO PLRG, AR1	MARCONI INSTRUMENTS LTD	
	43137/380	WIRE-LEAD-CRIMPED 9 WIRE, 7 & 16/0.2mm, CRIMP PLRJ, AR1 TO PLTD, AT11	MARCONI INSTRUMENTS LTD	
	43137/382	RIBBON-LEAD 10 WAY, SOCKET 10 WAY, - SOCKET 10 PLTC, AT11 TO PLFH, AF2/X	MARCONI INSTRUMENTS LTD	
	43137/519	WIRE-LEAD-CRIMPED 2 WIRE, 7/0.2mm, CRIMP HOUSING 3 BATTERY HOLDER TO PLRH, AR1	MARCONI INSTRUMENTS LTD	
	43137/989	WIRE-LEAD-CRIMPED 4 WIRE, 24/0.2mm, CRIMP HOUSING RECTIFIERS TO PLRA, AR1	MARCONI INSTRUMENTS LTD	
	43137/524	WIRE-LEAD-SOLDERED 4 WIRE, 16/0.2mm, ROCKER SWITCH	MARCONI INSTRUMENTS LTD	
	43137/531	RF-CABLE FLEXIBLE RG178B/U, 50 OHMS, CRIMP SKT EXT MOD 1, EXT MOD 2, LF OUTPUT TO PKAJ, AA1/X	MARCONI INSTRUMENTS LTD	
	43137/653	RIBBON-LEAD 34 WAY, SOCKET 34 WAY, KEY POS 16, - PLAN, AA1/X TO CAPACITOR FIELD	MARCONI INSTRUMENTS LTD	
	43137/654	RIBBON-LEAD 32 WAY, SOCKET 16 WAY, 2-OFF, 1-KEY PLBJ AND PLBK, AB2/X TO FILTER ASSEMBLY	MARCONI INSTRUMENTS LTD	
	43137/847	RF-CABLE FLEXIBLE RG178B/U, 50 OHMS, SMB FEMALE PULSE INPUT (WHEN OPTION 002 FITTED)	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
A1	**2030 series common parts (contd.)**			
	44990/971	FILTER ASSY BETWEEN PLAN, AA1/2 AND PLBJ, PLBK ON AB2/2	MARCONI INSTRUMENTS LTD	
	23411/066	FUSE TIME-LAG 1A RATING, 20mm LONG x 5mm DIA 220 - 240 V	SCHURTER SWITZERLAND	FTT TYPE-0034.5043
	23411/072	FUSE TIME-LAG 1.6A RATING, 20mm LONG x 5mm DIA 110 - 120 V	SCHURTER SWITZERLAND	FTT TYPE-0034.5045
	23467/260	MODULE OPTO SHAFT ENCODER, 64 CYCLES/REV, 5V 26mA 0.25in DIA PLAIN SHAFT, 0.625in LONG, 3/8"-32UNEF	BOURNS ELECTRONICS	ENA1J-B20-L00064 5
X13	23711/106	BATTERY PRIMARY 1 CELL, 3.5V LITHIUM-THIONYLCHLR, 1.8 AMP-HRS, SIZE-AA, STANDARD PRESSURE CONTACTS.	(STD.CONTACT) SAFT (UK) LTD	LS6 AA
X14	23711/194	BATTERY HOLDER 1 CELL, SIZE-AA, PANEL MOUNTING, BAYONET CAP WITH COIN SLOT, BLACK, 2.8mm TABS.	A.F. BULGIN & CO PLCD	BX0011/1
	28624/307	DISPLAY LIQUID CRYSTAL, BLUE, 400 x 200 DOT MATRIX, 162mm x 84mm VIEWING AREA, GRAPHIC MODULE	EPSON (UK) LTD	ECM-A0310
	43137/520	FAN AXIAL-FLOW, BRUSHLESS, ASSEMBLY, 24V DC, WITH	MARCONI INSTRUMENTS LTD	
	43137/608	TRANSFORMER MAINS, TOROIDAL TYPE, 2x 120V PRIMARY,	MARCONI INSTRUMENTS LTD	
	44829/542	PCB ASSEMBLY MIXED TECHNOLOGY, AB1, VCO	MARCONI INSTRUMENTS LTD	
	44829/543	PCB ASSEMBLY CONVENTIONAL, AR1, PSU	MARCONI INSTRUMENTS LTD	
	44829/800	PCB ASSEMBLY MIXED TECHNOLOGY, AA1/2, CONTROL	MARCONI INSTRUMENTS LTD	
	44829/791	PCB ASSEMBLY MIXED TECHNOLOGY, AB2/2, RF	MARCONI INSTRUMENTS LTD	
	44829/548	PCB ASSEMBLY CONVENTIONAL, AF1, KEY MATRIX	MARCONI INSTRUMENTS LTD	
	44829/782	PCB ASSEMBLY MIXED TECHNOLOGY, AF2/1, FRONT PANEL	MARCONI INSTRUMENTS LTD	
	44829/550	PCB ASSEMBLY CONVENTIONAL, AR2, INT FREQ STANDARD	MARCONI INSTRUMENTS LTD	
	44829/697	PCB ASSEMBLY CONVENTIONAL, AB4/1, BFO	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
A2	**2030 version additional components**		**Issue 3**	
	43137/634	RF-CABLE SEMI-RIGID UT141, 50 OHMS, SMA MALE PLXJ ON RF TRAY TO PLTB ON ATTENUATOR	MARCONI INSTRUMENTS LTD	
	44429/061	ATTENUATOR ASSY - SEVEN STAGE EDGELINE, AT10	MARCONI INSTRUMENTS LTD	
	44829/532	PCB ASSEMBLY SURFACE MOUNT, AB3/1, BFO SWITCH AND RPP	MARCONI INSTRUMENTS LTD	
A2	**2031 version additional components**		**Issue 5**	
	43137/634	RF-CABLE SEMI-RIGID UT141, 50 OHMS, SMA MALE PLXJ ON RF TRAY TO PLTB ON ATTENUATOR	MARCONI INSTRUMENTS LTD	
	44429/061	ATTENUATOR ASSY - SEVEN STAGE EDGELINE, AT10.	MARCONI INSTRUMENTS LTD	
	44829/772	PCB ASSEMBLY SURFACE MOUNT, AB3/5, FREQUENCY DOUBLER	MARCONI INSTRUMENTS LTD	
A2	**2032 version additional components**		**Issue 5**	
	43137/879	RF OUTPUT RF-CABLE SEMI-RIGID UT85, 50 OHMS, SMA FEMALE TO PLXJ	MARCONI INSTRUMENTS LTD	
	43137/974	RF-CABLE SEMI-RIGID UT141, 50 OHMS, SMA MALE PLXJ ON RF TRAY TO PLTB ON ATTENUATOR	MARCONI INSTRUMENTS LTD	
	43137/848	RIBBON-LEAD 20 WAY, SOCKET 20 WAY, KEY POS 16, - PLBL ON AB2/2 TO FILTER WALL	MARCONI INSTRUMENTS LTD	
	44429/062	ATTENUATOR ASSY 7-STAGE EDGELINE, AT10	MARCONI INSTRUMENTS LTD	
	44829/646	PCB ASSEMBLY SURFACE MOUNT, AB3/4, QUADRUPLER	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
A3	**Option 001, 2nd mod osc**			**Issue 1**
IC209	28469/508	IC DIGITAL ARRAY-LOGIC L5A0586.. AUDIO SYNTHESIZER TO MI CUSTOM SPEC, CMOS, 68 PIN, PLCC.	LSI LOGIC LTD	L5A0586
IC212	28461/981	IC ANALOGUE D/A-CONVERTER PCM54... 16 BIT, BIPOLAR, MONOLITHIC, 28 PIN, DUAL-IN-LINE.	BURR-BROWN INTERNAT	PCM54JP
IC213	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE.	ANALOG DEVICES LTD	OP42EZ
IC214	28461/424	IC ANALOGUE SAMPLE/HOLD AMP HA5330... 2 INPUT, SINGLE, 20V PRECISION, VERY HIGH SPEED,	HARRIS SEMICONDUCTOR	HA1-5330-5
A4	**Option 002, pulse mod**			**Issue 4**
C303	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C310	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
R359	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R360	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
	43137/848	RIBBON-LEAD 20 WAY, SOCKET 20 WAY, KEY POS 16, - PLBL ON AB2/2 TO FILTER WALL	MARCONI INSTRUMENTS LTD	
	46884/600	PULSE SCREEN ASSEMBLY	MARCONI INSTRUMENTS LTD	
	23444/331	CONNECTOR-RF SMB-TYPE MALE, RECEPTACLE, 50 OHMS, PLXA TO PLBP	GREENPAR (DUBILIER)	B65M19J999X02
	43137/847	RF-CABLE FLEXIBLE RG178B/U, 50 OHMS, SMB FEMALE PULSE INPUT	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
A5	**Option 003, 19 dBm RF output**			**Issue 2**
	43137/634	RF-CABLE SEMI-RIGID UT141, 50 OHMS, SMA MALE PLXJ ON RF TRAY TO PLTB ON ATTENUATOR	MARCONI INSTRUMENTS LTD	
	44429/061	ATTENUATOR ASSY - SEVEN STAGE EDGELINE, AT10	MARCONI INSTRUMENTS LTD	
	44829/547	PCB ASSEMBLY SURFACE MOUNT, AB3/3, HIGH POWER AMP	MARCONI INSTRUMENTS LTD	
A6	**Option 100, single fuse**			**Issue 3**
	23423/174	44991/001 CONNECTOR MAINS, PLUG, 3 WAY, RF FILTER, SINGLE (FITTED IN PLACE OF 23423/171 ON UNIT A0)	SCHAFFNER EMC LTD	FN376-6/21
A7	**Option 101, sweep ramp mod**			**Issue 3**
	44533/388	IC PROGRAMMED EPROM, SET OF 4	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AA1/2 Control board

Issue 13

When ordering, prefix circuit reference with AA1/2

	44829/800	Complete unit		
C101	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C102	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C103	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C104	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C105	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C106	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
C107	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C108	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C109	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C110	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C111	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C112	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C113	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C114	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C115	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C116	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C117	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C118	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C119	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C120	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C121	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C122	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C123	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C124	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C125	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C126	26383/007	CAPACITOR FIXED CERAMIC 22nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD108-979F-223-Z-50
C127	26343/435	CAPACITOR FIXED CERAMIC 220pF +/-2% 63V N750 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-58221
C130	26486/219	CAPACITOR FIXED TANTALUM 4.7uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-G-3-08-4.7-M-FSPB
C131	26582/426	CAPACITOR FIXED POLYESTER 10nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0103 KDC
C132	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C133	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C134	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C135	26421/122	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	35 TWMS 100 M
C136	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C137	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C138	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C201	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C204	26538/827	CAPACITOR FIXED POLYSTYRENE 220pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-220pF-2%-63V
C205	26538/635	CAPACITOR FIXED POLYSTYRENE 470pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-470pF-2%-63V
C206	26538/530	CAPACITOR FIXED POLYSTYRENE 33pF +/-1pF 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-33pF-+/-1pF-63V
C207	26538/635	CAPACITOR FIXED POLYSTYRENE 470pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-470pF-2%-63V
C208	26538/531	CAPACITOR FIXED POLYSTYRENE 62pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-62pF-2%-63V
C209	26538/635	CAPACITOR FIXED POLYSTYRENE 470pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-470pF-2%-63V
C210	26538/530	CAPACITOR FIXED POLYSTYRENE 33pF +/-1pF 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-33pF-+/-1pF-63V
C211	26538/827	CAPACITOR FIXED POLYSTYRENE 220pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-220pF-2%-63V
C212	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C215	26538/827	CAPACITOR FIXED POLYSTYRENE 220pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-220pF-2%-63V
C216	26538/635	CAPACITOR FIXED POLYSTYRENE 470pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-470pF-2%-63V
C217	26538/530	CAPACITOR FIXED POLYSTYRENE 33pF +/-1pF 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-33pF-+/-1pF-63V

AA1/2 Control board (contd.)

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C218	26538/635	CAPACITOR FIXED POLYSTYRENE 470pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-470pF-2%-63V
C219	26538/531	CAPACITOR FIXED POLYSTYRENE 62pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-62pF-2%-63V
C220	26538/635	CAPACITOR FIXED POLYSTYRENE 470pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-470pF-2%-63V
C221	26538/530	CAPACITOR FIXED POLYSTYRENE 33pF +/-1pF 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-33pF-+/-1pF-63V
C222	26538/827	CAPACITOR FIXED POLYSTYRENE 220pF +/-2% 63V 150 ppm/DEG.C, RADIAL, 7.6mm PWP, (TAPED).	SUFLEX LTD	EP9-220pF-2%-63V
C223	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C224	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C226	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C227	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C228	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C230	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C231	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C232	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C233	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C234	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C235	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C236	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C237	26582/430	CAPACITOR FIXED POLYESTER 220nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF024 D 0224 KDC
C238	26582/430	CAPACITOR FIXED POLYESTER 220nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF024 D 0224 KDC
C239	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C240	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C241	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C242	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C243	26343/447	CAPACITOR FIXED CERAMIC 330pF +/-2% 63V N750 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-58331
C244	26343/447	CAPACITOR FIXED CERAMIC 330pF +/-2% 63V N750 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-58331
C301	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
C302	26582/430	CAPACITOR FIXED POLYESTER 220nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF024 D 0224 KDC
C304	26421/124	CAPACITOR FIXED ALUMINIUM 220uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, 13mm HIGH MAX,	RUBYCON CAPACITORS	16 TWMS 220 M
C305	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C306	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C307	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C308	26582/430	CAPACITOR FIXED POLYESTER 220nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF024 D 0224 KDC
C310	26421/124	CAPACITOR FIXED ALUMINIUM 220uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, 13mm HIGH MAX,	RUBYCON CAPACITORS	16 TWMS 220 M
C311	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C312	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C313	26343/497	CAPACITOR FIXED CERAMIC 12pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10129
C314	26343/497	CAPACITOR FIXED CERAMIC 12pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10129
C315	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C316	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C317	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C318	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C319	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C320	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C321	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C322	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C323	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C324	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C325	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C326	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C327	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C328	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C329	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C330	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C331	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C332	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C333	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C334	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C335	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C336	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C337	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C338	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C339	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C340	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C341	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C342	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C343	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C344	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C345	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C346	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C347	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C348	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C349	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C350	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C351	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C352	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C353	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
C354	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
C355	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
C356	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C357	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C358	26582/430	CAPACITOR FIXED POLYESTER 220nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF024 D 0224 KDC
C359	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C360	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
C363	26343/499	CAPACITOR FIXED CERAMIC 27pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34279
C364	26383/582	CAPACITOR FIXED CERAMIC 470pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51471
C401	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C402	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C403	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C404	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C405	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
C406	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
C407	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C408	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C409	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C410	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C411	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C412	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C413	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
C414	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
C415	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C416	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C417	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C420	26582/428	CAPACITOR FIXED POLYESTER 47nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014-D-0473-KDC
C421	26582/428	CAPACITOR FIXED POLYESTER 47nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014-D-0473-KDC

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C422	26383/582	CAPACITOR FIXED CERAMIC 470pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51471
C423	26343/447	CAPACITOR FIXED CERAMIC 330pF +/-2% 63V N750 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-58331
C428	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C429	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C430	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C431	26343/488	CAPACITOR FIXED CERAMIC 8.2pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09828
C432	26343/488	CAPACITOR FIXED CERAMIC 8.2pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09828
C433	26343/492	CAPACITOR FIXED CERAMIC 10pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10109
C434	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C435	26343/492	CAPACITOR FIXED CERAMIC 10pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10109
C436	26582/437	CAPACITOR FIXED POLYESTER 150nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF024 D 0154 KDC
C437	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C438	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C439	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C440	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C441	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
C442	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C443	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C445	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C446	26343/434	CAPACITOR FIXED CERAMIC 68pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34689
C447	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
C448	26582/438	CAPACITOR FIXED POLYESTER 330nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF074 D 0334 KDC
C501	26421/112	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-10-M
C502	26343/492	CAPACITOR FIXED CERAMIC 10pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10109
C503	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
C504	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C505	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C506	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C507	26383/582	CAPACITOR FIXED CERAMIC 470pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51471
C508	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C509	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C510	26582/426	CAPACITOR FIXED POLYESTER 10nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0103 KDC
C511	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C512	26582/428	CAPACITOR FIXED POLYESTER 47nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014-D-0473-KDC
C513	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C514	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C515	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C516	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C517	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C518	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C519	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C520	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C521	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C522	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C523	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C524	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C525	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C526	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C528	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C529	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C530	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C531	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C532	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C533	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C534	26343/484	CAPACITOR FIXED CERAMIC 2.7pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09278
C537	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C538	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C539	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C540	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C541	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C542	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C543	26582/437	CAPACITOR FIXED POLYESTER 150nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF024 D 0154 KDC
C544	26421/124	CAPACITOR FIXED ALUMINIUM 220uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, 13mm HIGH MAX,	RUBYCON CAPACITORS	16 TWMS 220 M
C545	26421/124	CAPACITOR FIXED ALUMINIUM 220uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, 13mm HIGH MAX,	RUBYCON CAPACITORS	16 TWMS 220 M
C546	26421/122	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	35 TWMS 100 M
C547	26421/126	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16 TWSS 470 M
C548	26421/126	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16 TWSS 470 M
C549	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C550	26383/590	CAPACITOR FIXED CERAMIC 3.9nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51392
C552	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C553	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C554	26421/112	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-10-M
C555	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C556	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C557	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C558	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C559	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C560	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C561	26343/434	CAPACITOR FIXED CERAMIC 68pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34689
C562	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
C563	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
C564	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C565	26343/437	CAPACITOR FIXED CERAMIC 100pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34101
C601	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C602	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C603	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C604	26878/407	CAPACITOR VARIABLE POLYPROPYLENE 2pF to 22pF 100V VERTICAL-PCB MOUNT, 7.5mm DIA, 10mm LONG, 3 PIN,	DAU COMPONENTS LTD	107-2801-022
C605	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C606	26421/124	CAPACITOR FIXED ALUMINIUM 220uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, 13mm HIGH MAX,	RUBYCON CAPACITORS	16 TWMS 220 M
C607	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C608	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C609	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C610	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C611	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C612	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C613	26343/437	CAPACITOR FIXED CERAMIC 100pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34101
C615	26582/436	CAPACITOR FIXED POLYESTER 68nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0683 KDC
C616	26582/436	CAPACITOR FIXED POLYESTER 68nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0683 KDC
C617	26343/437	CAPACITOR FIXED CERAMIC 100pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34101
C618	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C619	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C620	26343/484	CAPACITOR FIXED CERAMIC 2.7pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09278
C621	26343/484	CAPACITOR FIXED CERAMIC 2.7pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09278
C622	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C623	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C624	26421/122	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	35 TWMS 100 M
C625	26421/122	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	35 TWMS 100 M
C626	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C627	26582/426	CAPACITOR FIXED POLYESTER 10nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0103 KDC
C628	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C629	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C630	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C631	26421/126	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16 TWSS 470 M
C632	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C633	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C634	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C635	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C636	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C637	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C638	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C639	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C640	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C641	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C643	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C644	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C645	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C646	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C647	26421/126	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16 TWSS 470 M
C649	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C650	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50

AA1/2 Control board (contd.)

Clr. Ref.	Mi part number	Description	Manufacturer	Manufacturer's part no.
C651	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C652	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C653	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C654	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C655	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C656	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C657	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C658	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C659	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C660	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C661	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C662	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C663	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C664	26582/428	CAPACITOR FIXED POLYESTER 47nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014-D-0473-KDC
C665	26582/428	CAPACITOR FIXED POLYESTER 47nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014-D-0473-KDC
C666	26582/428	CAPACITOR FIXED POLYESTER 47nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014-D-0473-KDC
C667	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C668	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C669	26421/126	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16 TWSS 470 M
C670	26421/118	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	6.3-MS7-100-M
C671	26421/109	CAPACITOR FIXED ALUMINIUM 3.3uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-3.3-M
C672	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C673	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C674	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C675	26343/437	CAPACITOR FIXED CERAMIC 100pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34101
C676	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
C677	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C678	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C679	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C680	26386/803	CAPACITOR FIXED CERAMIC 1.8pF +/-0.5pF 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 1R8 DAT 00 J
C701	26333/229	CAPACITOR FIXED CERAMIC 50pF +/-10% 300V N1500 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT103/1-N1500-47pF
C702	26333/229	CAPACITOR FIXED CERAMIC 50pF +/-10% 300V N1500 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT103/1-N1500-47pF
C703	26333/229	CAPACITOR FIXED CERAMIC 50pF +/-10% 300V N1500 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT103/1-N1500-47pF
C704	26333/229	CAPACITOR FIXED CERAMIC 50pF +/-10% 300V N1500 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT103/1-N1500-47pF
C705	26333/229	CAPACITOR FIXED CERAMIC 50pF +/-10% 300V N1500 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT103/1-N1500-47pF
C706	26333/229	CAPACITOR FIXED CERAMIC 50pF +/-10% 300V N1500 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT103/1-N1500-47pF
C707	26333/229	CAPACITOR FIXED CERAMIC 50pF +/-10% 300V N1500 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT103/1-N1500-47pF
C708	26333/229	CAPACITOR FIXED CERAMIC 50pF +/-10% 300V N1500 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT103/1-N1500-47pF
C709	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
D101	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D301	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D302	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D303	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D304	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D305	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D306	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D307	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D308	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D309	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D310	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
D311	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D312	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D313	28371/844	DIODE ZENER, BZX79-C10... 500mW 10V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C10
D314	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D315	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D316	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D317	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D318	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D319	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D320	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D321	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D322	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D323	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D324	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D401	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D402	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D403	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D404	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D405	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D406	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D407	28371/224	DIODE ZENER, BZX79-C3V6... 500mW 3.6V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C3V6
D408	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D409	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D502	28371/494	DIODE VOLTAGE REFERENCE, 1N825... 250mW 6.2V 5% 50mA 20ppm/DEG.C, AXIAL, DO-35, (TAPED).	PHILIPS	1N825
D503	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D504	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
D505	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D506	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D507	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D508	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D509	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D510	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D511	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D601	28381/101	DIODE VARIABLE CAPACITNCE, BB405B... 30V 20mA 11.5pF @ 3V, CAPAC RATIO 4.8 MIN, AXIAL, DO-34,	PHILIPS	BB405B
D602	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D603	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D604	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D605	28371/401	DIODE ZENER, BZX79-C5V1... 500mW 5.1V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V1
D606	28371/401	DIODE ZENER, BZX79-C5V1... 500mW 5.1V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V1
D613	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D614	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D615	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D616	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D617	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148

-Note that programmed EPROMs are to be found at the end of this IC section -

IC101	28467/041	IC MICRO PROCESSOR, 8 BIT, 80188... 8MHz, HIGH INTEGRATION, 68 PIN, JEDEC-TYPE-A-LCC.	ADVANCED MICRO DEV	R80188
IC102	28462/422	IC DIGITAL LATCH 74HCT573.. OCTAL, TRI-STATE, NON-INVERTING, TRANSPARENT, D-TYPE,	HARRIS SEMICONDUCTOR	CD74HCT573E
IC103	28462/422	IC DIGITAL LATCH 74HCT573.. OCTAL, TRI-STATE, NON-INVERTING, TRANSPARENT, D-TYPE,	HARRIS SEMICONDUCTOR	CD74HCT573E
IC104	28469/128	IC DIGITAL BUFFER/LINE-DRIVER 74HC244.. 1 INPUT, OCTAL, NON-INVERTING, TRI-STATE BUS, CMOS-H/SPEED,	HARRIS SEMICONDUCTOR	CD74HC244E

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
IC105	28462/139	IC DIGITAL FLIP-FLOP/D-TYPE 74HCT377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED+TTL,	HARRIS SEMICONDUCTOR	CD74HCT377E
IC106	28461/689	IC DIGITAL COMPARATOR 74HC85... 4 BIT, MAGNITUDE, CMOS-H/SPEED, 16 PIN, DUAL-IN-LINE.	MOTOROLA INC.	MC74HC85N
IC107	28462/139	IC DIGITAL FLIP-FLOP/D-TYPE 74HCT377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED+TTL,	HARRIS SEMICONDUCTOR	CD74HCT377E
IC108	28461/672	IC DIGITAL COMPARATOR 74HC688... SINGLE, 2 x 8 BIT WORDS, CMOS-H/SPEED, 20 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	MM74HC688N
IC110	28469/143	IC DIGITAL BUFFER/LINE-DRIVER 74HCT541.. OCTAL, TRI-STATE, NON-INVERTING, CMOS-H/SPEED+TTL, 20	NAT. SEMICONDUCTOR	MM74HCT541N
IC113	28467/025	IC MICRO CONTROLLER, 7210... INTERFACE BUS TALK/LISTEN/CONTROL, NMOS, 40 PIN, DUAL-IN-LINE.	STANDARD MICROSYSTMS	COM7210P
IC115	28469/114	IC DIGITAL TRANSCEIVER 75160... OCTAL, GPIB DATA, TTL-SCHOTTKY-L/PWR, 20 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	DS75160AN
IC116	28469/115	IC DIGITAL TRANSCEIVER 75161... OCTAL, GPIB-CONTROLLER, TTL-SCHOTTKY-L/PWR, 20 PIN,	NAT. SEMICONDUCTOR	DS75161AN
IC117	28462/422	IC DIGITAL LATCH 74HCT573.. OCTAL, TRI-STATE, NON-INVERTING, TRANSPARENT, D-TYPE,	HARRIS SEMICONDUCTOR	CD74HCT573E
IC118	28469/141	IC DIGITAL TRANSCEIVER 74HCT245.. OCTAL, TRI-STATE, NON-INVERTING, BI-DIRECTIONAL,	HARRIS SEMICONDUCTOR	CD74HCT245E
IC119	28466/113	IC DIGITAL OR-GATE 74HCT32.. 2 INPUT, QUAD, CMOS-H/SPEED+TTL, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HCT32E
IC120	28469/323	IC MICRO STATIC-RAM, 32K x 8 BIT, 43256-12.. 120nS ACCESS TIME, +5V, NO CLOCK OR TIMING STROBE	SONY (UK) LTD	CXK58256P-12L
IC121	28466/020	IC DIGITAL AND-GATE 74HC08.. 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC08E
IC122	28469/137	IC DIGITAL INVERTER 74HC04.. HEX, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC04E
IC123	28465/041	IC DIGITAL DECODER/DEMULTIPLEX 74HC139.. 2 INPUT, 4 BIT, DUAL, INVERTING, 1 BIT ADDRESS,	HARRIS SEMICONDUCTOR	CD74HC139E
IC124	28466/365	IC DIGITAL NAND-GATE 74HC00... 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC00E
IC125	28467/546	IC DIGITAL SHIFT-REGISTER 74HCT165... 8 BIT, PARALLEL-IN SERIAL-OUT, CMOS-H/SPEED+TTL, 16 PIN,	HARRIS SEMICONDUCTOR	CD74HCT165E
IC126	28467/547	IC DIGITAL SHIFT-REGISTER 74HC595... 8 BIT, SINGLE, TRI-STATE, CMOS-H/SPEED, 16 PIN,	SGS-THOMSON	M74HC595B1N
IC127	28466/113	IC DIGITAL OR-GATE 74HCT32.. 2 INPUT, QUAD, CMOS-H/SPEED+TTL, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HCT32E
IC129	28469/176	IC DIGITAL INVERTER 74LS14... HEX, SCHMITT-TRIGGER OPERATION, TTL-SCHOTTKY-L/PWR, 14 PIN,	PHILIPS	N74LS14N
IC201	28469/508	IC DIGITAL ARRAY-LOGIC L5A0586... AUDIO SYNTHESIZR TO MI CUSTOM SPEC, CMOS, 68 PIN, PLCC.	LSI LOGIC LTD	L5A0586
IC203	28462/138	IC DIGITAL FLIP-FLOP/D-TYPE 74HC574.. OCTAL, TRI-STATE, NON-INVERTING, POS EDGE TRIGGER,	SGS-THOMSON	M74HC574B1N
IC204	28462/138	IC DIGITAL FLIP-FLOP/D-TYPE 74HC574.. OCTAL, TRI-STATE, NON-INVERTING, POS EDGE TRIGGER,	SGS-THOMSON	M74HC574B1N
IC205	28461/981	IC ANALOGUE D/A-CONVERTER PCM54... 16 BIT, BIPOLAR, MONOLITHIC, 28 PIN, DUAL-IN-LINE.	BURR-BROWN INTERNAT	PCM54JP
IC206	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE.	ANALOG DEVICES LTD	OP42EZ
IC207	28461/424	IC ANALOGUE SAMPLE/HOLD AMP HA5330... 2 INPUT, SINGLE, 20V PRECISION, VERY HIGH SPEED,	HARRIS SEMICONDUCTOR	HA1-5330-5

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
IC208	28469/739	IC ANALOGUE MULTIPLEXER 74HC4053.. TRIPLE, 2 CHANNEL, 1 SELECT INPUT PLUS ENABLE, CMOS-H/SPEED,	HARRIS SEMICONDUCTOR	CD74HC4053E
IC209	28469/508	IC DIGITAL ARRAY-LOGIC L5A0586.. AUDIO SYNTHESIZER TO MI CUSTOM SPEC, CMOS, 68 PIN, PLCC (ONLY IF OPTION 001 FITTED)	LSI LOGIC LTD	L5A0586
IC210	28462/138	IC DIGITAL FLIP-FLOP/D-TYPE 74HC574.. OCTAL, TRI-STATE, NON-INVERTING, POS EDGE TRIGGER,	SGS-THOMSON	M74HC574B1N
IIC211	28462/138	IC DIGITAL FLIP-FLOP/D-TYPE 74HC574.. OCTAL, TRI-STATE, NON-INVERTING, POS EDGE TRIGGER,	SGS-THOMSON	M74HC574B1N
IC212	28461/981	IC ANALOGUE D/A-CONVERTER PCM54... 16 BIT, BIPOLAR, MONOLITHIC, 28 PIN, DUAL-IN-LINE (ONLY IF OPTION 001 FITTED)	BURR-BROWN INTERNAT	PCM54JP
IC213	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE (ONLY IF OPTION 001 FITTED)	ANALOG DEVICES LTD	OP42EZ
IC214	28461/424	IC ANALOGUE SAMPLE/HOLD AMP HA5330... 2 INPUT, (ONLY OF OPTION 001 FITTED)	HARRIS SEMICONDUCTOR	HA1-5330-5
IC301	28465/040	IC DIGITAL DECODER/DEMULTIPLEX 74HC138.. 3 INPUT, 8 BIT, SINGLE, INVERTING, 3 BIT ADDRESS,	HARRIS SEMICONDUCTOR	CD74HC138E
IC302	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC303	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC304	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC305	28461/347	IC ANALOGUE OPERATIONAL AMP TL071CP... SINGLE, JFET-INPUT, LINEAR, 8 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL071CP
IC306	28461/423	IC ANALOGUE OPERATIONAL AMP HA5147... 2 INPUT, SINGLE, 22V ULTRA LOW NOISE, HIGH SLEW RATE,	HARRIS SEMICONDUCTOR	HA3-5147-5
IC307	28461/349	IC ANALOGUE OPERATIONAL AMP TL074CN... QUAD, JFET-INPUT, LINEAR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL074CN
IC308	28461/347	IC ANALOGUE OPERATIONAL AMP TL071CP... SINGLE, JFET-INPUT, LINEAR, 8 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL071CP
IC309	28461/423	IC ANALOGUE OPERATIONAL AMP HA5147... 2 INPUT, SINGLE, 22V ULTRA LOW NOISE, HIGH SLEW RATE,	HARRIS SEMICONDUCTOR	HA3-5147-5
IC310	28461/349	IC ANALOGUE OPERATIONAL AMP TL074CN... QUAD, JFET-INPUT, LINEAR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL074CN
IC311	28469/737	IC ANALOGUE MULTIPLEXER 74HC4051.. SINGLE, 8 CHANNEL, 3 SELECT INPUTS PLUS ENABLE,	HARRIS SEMICONDUCTOR	CD74HC4051E
IC312	28469/737	IC ANALOGUE MULTIPLEXER 74HC4051.. SINGLE, 8 CHANNEL, 3 SELECT INPUTS PLUS ENABLE,	HARRIS SEMICONDUCTOR	CD74HC4051E
IC313	28469/737	IC ANALOGUE MULTIPLEXER 74HC4051.. SINGLE, 8 CHANNEL, 3 SELECT INPUTS PLUS ENABLE,	HARRIS SEMICONDUCTOR	CD74HC4051E
IC314	28469/737	IC ANALOGUE MULTIPLEXER 74HC4051.. SINGLE, 8 CHANNEL, 3 SELECT INPUTS PLUS ENABLE,	HARRIS SEMICONDUCTOR	CD74HC4051E
IC315	28469/737	IC ANALOGUE MULTIPLEXER 74HC4051.. SINGLE, 8 CHANNEL, 3 SELECT INPUTS PLUS ENABLE,	HARRIS SEMICONDUCTOR	CD74HC4051E
IC316	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE.	ANALOG DEVICES LTD	OP42EZ
IC317	28461/407	IC ANALOGUE OPERATIONAL AMP AD712JN.. DUAL, 15V PWR BANDWDTH 200kHz, SLEW-RATE 16V/uS, I/P OFFSET	ANALOG DEVICES LTD	AD712JN
IC318	28461/349	IC ANALOGUE OPERATIONAL AMP TL074CN... QUAD, JFET-INPUT, LINEAR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL074CN

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
IC319	28461/976	IC ANALOGUE D/A-CONVERTER AD7537... DUAL, 15V 12 BIT, 8+4 LOADING, REL-ACC +/-1/2 LSB, CMOS, 24	ANALOG DEVICES LTD	AD7537KN
IC320	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE.	ANALOG DEVICES LTD	OP42EZ
IC321	28469/737	IC ANALOGUE MULTIPLEXER 74HC4051.. SINGLE, 8 CHANNEL, 3 SELECT INPUTS PLUS ENABLE,	HARRIS SEMICONDUCTOR	CD74HC4051E
IC322	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE.	ANALOG DEVICES LTD	OP42EZ
IC323	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE.	ANALOG DEVICES LTD	OP42EZ
IC324	28461/494	IC ANALOGUE BUFFER-AMPLIFIER LT1010... 18V 200MHz BANDWIDTH, SLEW RATE 75V/uS, BIPOLAR, 5 PIN,	LINEAR TECHNOLOGY	LT1010CT
IC325	28461/736	IC ANALOGUE VOLTAGE-REGULATOR 79L05AC... 5V 100mA NEGATIVE, OUTPUT VOLTAGE ERROR <5% OVERLOAD,	NAT. SEMICONDUCTOR	LM79L05ACZ
IC401	28465/040	IC DIGITAL DECODER/DEMULTIPLEX 74HC138.. 3 INPUT, 8 BIT, SINGLE, INVERTING, 3 BIT ADDRESS,	HARRIS SEMICONDUCTOR	CD74HC138E
IC402	28461/976	IC ANALOGUE D/A-CONVERTER AD7537... DUAL, 15V 12 BIT, 8+4 LOADING, REL-ACC +/-1/2 LSB, CMOS, 24	ANALOG DEVICES LTD	AD7537KN
IC403	28461/442	IC ANALOGUE OPERATIONAL AMP AD845-KN.. SINGLE, 18V SLEW RATE 100V/uS, HIGH SPEED, PRECISION, JFET, 8	ANALOG DEVICES LTD	AD845-KN
IC404	28461/442	IC ANALOGUE OPERATIONAL AMP AD845-KN.. SINGLE, 18V SLEW RATE 100V/uS, HIGH SPEED, PRECISION, JFET, 8	ANALOG DEVICES LTD	AD845-KN
IC405	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE.	ANALOG DEVICES LTD	OP42EZ
IC406	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE.	ANALOG DEVICES LTD	OP42EZ
IC407	28461/399	IC ANALOGUE OPERATIONAL AMP OP42FZ... HIGH SPEED, FAST SETTLING 1uS, 8 PIN, DUAL-IN-LINE.	ANALOG DEVICES LTD	OP42EZ
IC408	28461/494	IC ANALOGUE BUFFER-AMPLIFIER LT1010... 18V 200MHz BANDWIDTH, SLEW RATE 75V/uS, BIPOLAR, 5 PIN,	LINEAR TECHNOLOGY	LT1010CT
IC409	28461/349	IC ANALOGUE OPERATIONAL AMP TL074CN... QUAD, JFET-INPUT, LINEAR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL074CN
IC411	28469/447	IC DIGITAL DRIVER ULN2803... 8 DARLINGTON ARRAYS, 50V, 500mA, TTL OR CMOS, 18 PIN, DUAL-IN-LINE.	ALLEGRO MICROSYSTEMS	ULN2803A
IC412	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC413	28469/132	IC DIGITAL BUFFER/LINE-DRIVER 74HC541.. OCTAL, TRI-STATE, NON-INVERTING, CMOS-H/SPEED, 20 PIN,	HARRIS SEMICONDUCTOR	CD74HC541E
IC414	28466/227	IC DIGITAL NOR-GATE 74HC02... 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC02E
IC501	28465/040	IC DIGITAL DECODER/DEMULTIPLEX 74HC138.. 3 INPUT, 8 BIT, SINGLE, INVERTING, 3 BIT ADDRESS,	HARRIS SEMICONDUCTOR	CD74HC138E
IC502	28461/976	IC ANALOGUE D/A-CONVERTER AD7537... DUAL, 15V 12 BIT, 8+4 LOADING, REL-ACC +/-1/2 LSB, CMOS, 24	ANALOG DEVICES LTD	AD7537KN
IC503	28461/349	IC ANALOGUE OPERATIONAL AMP TL074CN... QUAD, JFET-INPUT, LINEAR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL074CN
IC504	28461/348	IC ANALOGUE OPERATIONAL AMP TL072CP... DUAL, JFET-INPUT, LINEAR, 8 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL072CP
IC505	28461/976	IC ANALOGUE D/A-CONVERTER AD7537... DUAL, 15V 12 BIT, 8+4 LOADING, REL-ACC +/-1/2 LSB, CMOS, 24	ANALOG DEVICES LTD	AD7537KN
IC506	28461/407	IC ANALOGUE OPERATIONAL AMP AD712JN.. DUAL, 15V PWR BANDWDTH 200kHz, SLEW-RATE 16V/uS, I/P OFFSET	ANALOG DEVICES LTD	AD712JN

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
IC507	28461/984	IC ANALOGUE D/A-CONVERTER AD7225... QUAD, 8 BIT, SEPERATE REFERENCE INPUTS, CMOS, 24 PIN,	ANALOG DEVICES LTD	AD7225KN
IC508	28452/869	TRANSISTOR NPN BIPOLAR LM394CN.. MONOLITHIC PAIR, 20V 200MHz 500mW 20mA MATCHED, PLUS BASE/EMITTER	NAT. SEMICONDUCTOR	LM394CN
IC509	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC510	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC511	28466/345	IC DIGITAL NAND-GATE 74LS00... 2 INPUT, QUAD, TTL-SCHOTTKY-L/PWR, 14 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	DM74LS00N
IC512	28464/127	IC DIGITAL COUNTER 74LS390... 4 BIT, DUAL, DECADE RIPPLE, TTL-SCHOTTKY-L/PWR, 16 PIN, DUAL-IN-LINE.	MOTOROLA INC.	SN74LS390N
IC513	28469/719	IC DIGITAL MULTIPLEXER 74LS253... 4 INPUT, DUAL, TRI-STATE, TTL-SCHOTTKY-L/PWR, 16 PIN,	NAT. SEMICONDUCTOR	DM74LS253N
IC514	28469/031	IC DIGITAL BUFFER/LINE-DRIVER 74HC126... QUAD, TRI-STATE, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	SGS-THOMSON	M74HC126B1N
IC515	28464/034	IC DIGITAL DIVIDER SP8789DP... DIVIDE BY 20/21, 225MHz, TWO MODULUS, ECL, 8 PIN, DUAL-IN-LINE.	GEC PLESSEY SEMICOND	SP8789DP
IC516	44535/191	IC PROGRAMMED PAL, SET OF 1, 2031, 104.8576MHz DIVIDER.	MARCONI INSTRUMENTS LTD	
IC520	28462/611	IC DIGITAL FLIP-FLOP/D-TYPE 74LS74... 2 BIT, DUAL, POS EDGE TRIGGER, PLUS SET & CLEAR,	NAT. SEMICONDUCTOR	DM74LS74AN
IC521	28469/205	IC DIGITAL NAND-GATE 74LS132... 2 INPUT, QUAD, SCHMITT TRIGGER, TTL-SCHOTTKY-L/PWR, 14 PIN,	NAT. SEMICONDUCTOR	DM74LS132N
IC522	28461/349	IC ANALOGUE OPERATIONAL AMP TL074CN... QUAD, JFET-INPUT, LINEAR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL074CN
IC523	28461/757	IC ANALOGUE VOLTAGE-REFERENCE AD586... 36V 5V REF +/- 0.020V, OUTPUT DRIFT 25ppm, MONOLITHIC, 8 PIN,	ANALOG DEVICES LTD	AD586JQ
IC601	28464/015	IC DIGITAL DIVIDER SP8647B... DIVIDE BY 10/11, 200MHZ, ECL, 16 PIN, DUAL-IN-LINE.	GEC PLESSEY SEMICOND	SP8647BDG
IC602	28466/214	IC DIGITAL NOR-GATE 74LS02... 2 INPUT, QUAD, TTL-SCHOTTKY-L/PWR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	SN74LS02N
IC603	28464/125	IC DIGITAL COUNTER 74LS92... 4 BIT, RIPPLE, DIVIDE BY 12, TTL-SCHOTTKY-L/PWR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	SN74LS92N
IC604	28466/012	IC DIGITAL AND-GATE 74LS08... 2 INPUT, QUAD, TTL-SCHOTTKY-L/PWR, 14 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	DM74LS08N
IC605	28462/113	IC DIGITAL FLIP-FLOP/D-TYPE 74F74... 2 BIT, DUAL, POS EDGE TRIGGER, PLUS SET & CLEAR,	NAT. SEMICONDUCTOR	74F74PC
IC606	28466/345	IC DIGITAL NAND-GATE 74LS00... 2 INPUT, QUAD, TTL-SCHOTTKY-L/PWR, 14 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	DM74LS00N
IC607	28462/113	IC DIGITAL FLIP-FLOP/D-TYPE 74F74... 2 BIT, DUAL, POS EDGE TRIGGER, PLUS SET & CLEAR,	NAT. SEMICONDUCTOR	74F74PC
IC608	28466/219	IC DIGITAL NOR-GATE 10102... 2 INPUT, QUAD, ECL, 16 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	F10102PC
IC609	28464/159	IC DIGITAL COUNTER MC10H016... 4 BIT, BINARY, ECL, 16 PIN, DUAL-IN-LINE.	MOTOROLA INC.	MC10H016P
IC610	28464/159	IC DIGITAL COUNTER MC10H016... 4 BIT, BINARY, ECL, 16 PIN, DUAL-IN-LINE.	MOTOROLA INC.	MC10H016P
IC611	28464/159	IC DIGITAL COUNTER MC10H016... 4 BIT, BINARY, ECL, 16 PIN, DUAL-IN-LINE.	MOTOROLA INC.	MC10H016P
IC612	28464/035	IC DIGITAL DIVIDER SP8743BDG... DIVIDE BY 8/9, 500MHz ECL, 16 PIN, DUAL-IN-LINE.	GEC PLESSEY SEMICOND	SP8743BDG

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
IC613	28469/521	IC DIGITAL DIVIDER SP4904.... DIVIDE BY 4, 2.54GHz, PRESCALER, ECL, 8 PIN, DUAL-IN-LINE.	GEC PLESSEY SEMICOND	SP4904DP
IC614	28469/507	IC DIGITAL ARRAY-LOGIC L5A0704... FRACTIONAL N CONTROL CHIP TO MI CUSTOM SPEC, CMOS, 68 PIN,	LSI LOGIC LTD	L5A0704
IC615	28461/349	IC ANALOGUE OPERATIONAL AMP TL074CN... QUAD, JFET-INPUT, LINEAR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL074CN
IC616	28462/622	IC DIGITAL FLIP-FLOP/D-TYPE 74HC74.. 2 BIT, DUAL, POS EDGE TRIGGER, PLUS SET & CLEAR, CMOS-H/SPEED,	HARRIS SEMICONDUCTOR	CD74HC74E
IC617	28466/020	IC DIGITAL AND-GATE 74HC08.. 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC08E
IC618	28466/227	IC DIGITAL NOR-GATE 74HC02... 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC02E
IC109	44533/366	IC PROGRAMMED EPROM (A), 1 OF SET OF 4	MARCONI INSTRUMENTS LTD	
IC111	44533/366	IC PROGRAMMED EPROM (B), 1 OF SET OF 4	MARCONI INSTRUMENTS LTD	
IC112	44533/366	IC PROGRAMMED EPROM (C), 1 OF SET OF 4	MARCONI INSTRUMENTS LTD	
IC114	44533/367	INITIALISED EEPROM	MARCONI INSTRUMENTS LTD	
IC202	44533/368	WAVEFORM GENERATOR	MARCONI INSTRUMENTS LTD	
L101	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L201	23642/050	INDUCTOR FIXED 360uH +/- 5% COATED-EPOXY, 108mA 15R5 MAX, 65 Q @ 0.79 MHz, 4.8 MHz SRF, AXIAL,	DALE ELECTROSIL LTD	IR-4 360uH 5% TAPE
L202	23642/051	INDUCTOR FIXED 430uH +/- 5% COATED-EPOXY, 102mA 17R1 MAX, 65 Q @ 0.79 MHz, 4.2 MHz SRF, AXIAL,	SIGMA PRODUCTS LTD	05-10-1706-05 TAPE
L203	23642/051	INDUCTOR FIXED 430uH +/- 5% COATED-EPOXY, 102mA 17R1 MAX, 65 Q @ 0.79 MHz, 4.2 MHz SRF, AXIAL,	SIGMA PRODUCTS LTD	05-10-1706-05 TAPE
L204	23642/050	INDUCTOR FIXED 360uH +/- 5% COATED-EPOXY, 108mA 15R5 MAX, 65 Q @ 0.79 MHz, 4.8 MHz SRF, AXIAL,	DALE ELECTROSIL LTD	IR-4 360uH 5% TAPE
L205	23642/050	INDUCTOR FIXED 360uH +/- 5% COATED-EPOXY, 108mA 15R5 MAX, 65 Q @ 0.79 MHz, 4.8 MHz SRF, AXIAL,	DALE ELECTROSIL LTD	IR-4 360uH 5% TAPE
L206	23642/051	INDUCTOR FIXED 430uH +/- 5% COATED-EPOXY, 102mA 17R1 MAX, 65 Q @ 0.79 MHz, 4.2 MHz SRF, AXIAL,	SIGMA PRODUCTS LTD	05-10-1706-05 TAPE
L207	23642/051	INDUCTOR FIXED 430uH +/- 5% COATED-EPOXY, 102mA 17R1 MAX, 65 Q @ 0.79 MHz, 4.2 MHz SRF, AXIAL,	SIGMA PRODUCTS LTD	05-10-1706-05 TAPE
L208	23642/050	INDUCTOR FIXED 360uH +/- 5% COATED-EPOXY, 108mA 15R5 MAX, 65 Q @ 0.79 MHz, 4.8 MHz SRF, AXIAL,	DALE ELECTROSIL LTD	IR-4 360uH 5% TAPE
L401	23642/565	INDUCTOR FIXED 470uH +/- 10% COATED-LACQUER, MINIATURE, 87mA 26R5 MAX, 45 Q @ 0.79 MHz, 2.9 MHz	SIGMA PRODUCTS LTD	10-10-0545-10
L501	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L502	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L503	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L504	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
L505	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L506	23642/566	INDUCTOR FIXED 680uH +/- 10% COATED-LACQUER, MINIATURE, 78mA 33R MAX, 45 Q @ 0.79 MHz, 2.5 MHz	SIGMA PRODUCTS LTD	10-10-0547-10
L601	23642/481	INDUCTOR FIXED 0.15uH +/- 10% MOULDED-EPOXY, 2.45A 0R3 MAX, 50 Q @ 25 MHz, 525 MHz SRF, AXIAL,	SIGMA PRODUCTS LTD	15-10-1003-10 (TAPE)
L603	23642/492	INDUCTOR FIXED 0.47uH +/- 5% MOULDED-EPOXY, 1.225A 0R12 MAX, 45 Q @ 25 MHz, 310 MHz SRF, AXIAL,	SIGMA PRODUCTS LTD	15-10-1009-05
L605	23642/362	INDUCTOR FIXED 10mH +/- 10% SCREENED, MOULDED-EPOXY, 69mA 75R MAX, 70 Q @ 0.25 MHz, 0.7	INTERCONNECTION PROD	553-3635-49-02-00
L606	23642/362	INDUCTOR FIXED 10mH +/- 10% SCREENED, MOULDED-EPOXY, 69mA 75R MAX, 70 Q @ 0.25 MHz, 0.7	INTERCONNECTION PROD	553-3635-49-02-00
L607	23642/543	INDUCTOR FIXED 0.1uH +/- 20% COATED-LACQUER, MINIATURE, 2.8A 0R03 MAX, 50 Q @ 25 MHz, 500 MHz	SIGMA PRODUCTS LTD	10-10-0501-10
L608	23642/549	INDUCTOR FIXED 1uH +/- 10% COATED-LACQUER, MINIATURE, 820mA 0R3 MAX, 45 Q @ 25 MHz, 210 MHz	SIGMA PRODUCTS LTD	10-10-0513-10
L609	23642/549	INDUCTOR FIXED 1uH +/- 10% COATED-LACQUER, MINIATURE, 820mA 0R3 MAX, 45 Q @ 25 MHz, 210 MHz	SIGMA PRODUCTS LTD	10-10-0513-10
L610	23642/549	INDUCTOR FIXED 1uH +/- 10% COATED-LACQUER, MINIATURE, 820mA 0R3 MAX, 45 Q @ 25 MHz, 210 MHz	SIGMA PRODUCTS LTD	10-10-0513-10
L611	23642/549	INDUCTOR FIXED 1uH +/- 10% COATED-LACQUER, MINIATURE, 820mA 0R3 MAX, 45 Q @ 25 MHz, 210 MHz	SIGMA PRODUCTS LTD	10-10-0513-10
L612	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
R101	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R102	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R103	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-47K-G-T-1
R104	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R105	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R106	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R107	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R108	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R109	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R110	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R111	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R112	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R113	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R114	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R115	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R116	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R118	24681/655	RESISTOR NETWORK BUSSED, THICK-FILM, 2K2 2% 1W 50V 100 ppm/DEG.C, 9 RESISTORS, LOW PROFILE, 10 PIN,	BOURNS ELECTRONICS	4610X-101-222
R119	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R120	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R121	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R122	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R123	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R124	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R125	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R201	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R204	24772/074	RESISTOR FIXED METAL-FILM 1K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K1-G-T-1
R205	24772/074	RESISTOR FIXED METAL-FILM 1K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K1-G-T-1
R206	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R209	24772/074	RESISTOR FIXED METAL-FILM 1K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K1-G-T-1
R210	24772/074	RESISTOR FIXED METAL-FILM 1K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K1-G-T-1
R211	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-47K-G-T-1
R212	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R213	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R214	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-47K-G-T-1
R217	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R218	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R219	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R220	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R221	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R222	24772/066	RESISTOR FIXED METAL-FILM 510R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-510R-G-T-1
R223	24772/066	RESISTOR FIXED METAL-FILM 510R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-510R-G-T-1
R224	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R301	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R302	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R303	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/1M-F-T2
R304	24772/122	RESISTOR FIXED METAL-FILM 110K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-110K-G-T-1
R307	24724/001	RESISTOR FIXED METAL-FILM 1K2 +/- 0.1% 100mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	EE051K2BT2
R308	24724/004	RESISTOR FIXED METAL-FILM 68R +/- 0.1% 100mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	EE0568BT2
R309	24772/103	RESISTOR FIXED METAL-FILM 18K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-18K-G-T-1
R310	24724/002	RESISTOR FIXED METAL-FILM 910R +/- 0.1% 100mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	EE05910BT2
R312	24772/082	RESISTOR FIXED METAL-FILM 2K4 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K4-G-T-1
R313	24772/134	RESISTOR FIXED METAL-FILM 360K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/365K-F-T2
R314	24772/134	RESISTOR FIXED METAL-FILM 360K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/365K-F-T2
R315	24772/134	RESISTOR FIXED METAL-FILM 360K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/365K-F-T2
R316	24772/134	RESISTOR FIXED METAL-FILM 360K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/365K-F-T2
R317	24772/135	RESISTOR FIXED METAL-FILM 390K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/392K-F-T2
R318	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/1M-F-T2
R319	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R321	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/1M-F-T2
R322	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/1M-F-T2
R323	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15K-G-T-1
R324	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R325	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15K-G-T-1
R326	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R327	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R328	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R329	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/1M-F-T2
R330	24772/122	RESISTOR FIXED METAL-FILM 110K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-110K-G-T-1
R333	24724/001	RESISTOR FIXED METAL-FILM 1K2 +/- 0.1% 100mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	EE051K2BT2
R334	24724/004	RESISTOR FIXED METAL-FILM 68R +/- 0.1% 100mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	EE0568BT2
R335	24772/103	RESISTOR FIXED METAL-FILM 18K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-18K-G-T-1
R336	24724/002	RESISTOR FIXED METAL-FILM 910R +/- 0.1% 100mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	EE05910BT2
R338	24772/082	RESISTOR FIXED METAL-FILM 2K4 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K4-G-T-1
R339	24772/134	RESISTOR FIXED METAL-FILM 360K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/365K-F-T2
R340	24772/134	RESISTOR FIXED METAL-FILM 360K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/365K-F-T2
R341	24772/134	RESISTOR FIXED METAL-FILM 360K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/365K-F-T2
R342	24772/134	RESISTOR FIXED METAL-FILM 360K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/365K-F-T2
R343	24772/135	RESISTOR FIXED METAL-FILM 390K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/392K-F-T2
R344	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/1M-F-T2
R345	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R347	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/1M-F-T2
R348	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/1M-F-T2
R349	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15K-G-T-1
R350	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R351	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15K-G-T-1
R352	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R353	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R354	24772/075	RESISTOR FIXED METAL-FILM 1K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K2-G-T-1
R355	24723/334	RESISTOR FIXED METAL-FILM 1K18 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	VTM (UK) LTD	CE/410-0/1K18-B-T2
R356	24723/452	RESISTOR FIXED METAL-FILM 298R +/- 0.1% 250mW 200V 25 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	VTM (UK) LTD	CE/410-0/298R-B-T9

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R357	24723/390	RESISTOR FIXED METAL-FILM 75R +/- 0.1% 250mW 200V 15 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	VTM (UK) LTD	CE/410-0/75R-B-T10
R358	24723/453	RESISTOR FIXED METAL-FILM 25R2 +/- 0.1% 250mW 200V 25 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	VTM (UK) LTD	CE/410-0/25R2-B-T9
R359	24772/059	RESISTOR FIXED METAL-FILM 270R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-270R-G-T-1
R360	24772/078	RESISTOR FIXED METAL-FILM 1K6 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K6-G-T-1
R361	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R362	24772/033	RESISTOR FIXED METAL-FILM 22R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-22R-G-T-1
R363	24772/052	RESISTOR FIXED METAL-FILM 130R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	CMF51-130R-G-T-1
R364	24772/019	RESISTOR FIXED METAL-FILM 5R6 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	BEYSCHLAG (GERMANY)	MBA0204-00-BX-5R6-2%
R365	24753/334	RESISTOR FIXED METAL-FILM 1K4 +/- 0.5% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	VTM (UK) LTD	CE/410-0/1K4-D-T2
R366	24772/019	RESISTOR FIXED METAL-FILM 5R6 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	BEYSCHLAG (GERMANY)	MBA0204-00-BX-5R6-2%
R367	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R368	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R369	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R371	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R372	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R373	24724/003	RESISTOR FIXED METAL-FILM 33K +/- 0.1% 100mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	EE0533KBT2
R375	24724/003	RESISTOR FIXED METAL-FILM 33K +/- 0.1% 100mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	EE0533KBT2
R377	24772/033	RESISTOR FIXED METAL-FILM 22R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-22R-G-T-1
R378	24772/033	RESISTOR FIXED METAL-FILM 22R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-22R-G-T-1
R401	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R402	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R403	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-47K-G-T-1
R404	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R405	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R406	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R407	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R408	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R409	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R410	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R411	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R412	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R413	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R414	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R415	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R416	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15K-G-T-1
R417	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R418	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R419	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R420	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R421	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R422	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R423	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R424	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R425	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R426	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R427	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R428	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R429	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R430	24772/074	RESISTOR FIXED METAL-FILM 1K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K1-G-T-1
R431	24772/107	RESISTOR FIXED METAL-FILM 27K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-27K-G-T-1
R432	24772/083	RESISTOR FIXED METAL-FILM 2K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K7-G-T-1
R433	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R434	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R435	24772/033	RESISTOR FIXED METAL-FILM 22R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-22R-G-T-1
R437	24772/035	RESISTOR FIXED METAL-FILM 27R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-27R-G-T-1
R438	24723/485	RESISTOR FIXED METAL-FILM 291R +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-291R+/-0.1% 50PPM
R439	24723/485	RESISTOR FIXED METAL-FILM 291R +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-291R+/-0.1% 50PPM
R440	24723/479	RESISTOR FIXED METAL-FILM 17R7 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-17R7+/-0.1% 50PPM
R441	24723/488	RESISTOR FIXED METAL-FILM 150R +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-150R-0.1%-50PPM
R442	24723/488	RESISTOR FIXED METAL-FILM 150R +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-150R-0.1%-50PPM
R443	24723/480	RESISTOR FIXED METAL-FILM 37R5 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-37R5+/-0.1% 50PPM
R444	24723/483	RESISTOR FIXED METAL-FILM 83R3 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-83R3+/-0.1% 50PPM
R445	24723/483	RESISTOR FIXED METAL-FILM 83R3 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-83R3+/-0.1% 50PPM
R446	24723/484	RESISTOR FIXED METAL-FILM 93R8 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-93R8+/-0.1% 50PPM
R447	24723/482	RESISTOR FIXED METAL-FILM 56R7 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-56R7+/-0.1% 50PPM
R448	24723/482	RESISTOR FIXED METAL-FILM 56R7 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-56R7+/-0.1% 50PPM
R449	24723/486	RESISTOR FIXED METAL-FILM 398R4 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-398R4+/-0.1%50PPM
R450	24681/645	RESISTOR NETWORK BUSSED, THICK-FILM, 100R 5% 1.6W 50V 100 ppm/DEG.C, 8 RESISTORS, LOW PROFILE, 9	BOURNS ELECTRONICS	4609X-101-101
R451	24772/107	RESISTOR FIXED METAL-FILM 27K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-27K-G-T-1
R452	24772/122	RESISTOR FIXED METAL-FILM 110K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-110K-G-T-1
R453	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-20K-G-T-1
R454	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-20K-G-T-1
R455	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R456	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R457	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R458	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-20K-G-T-1
R459	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R461	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R462	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R463	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R464	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R465	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-33K-G-T-1
R470	24772/115	RESISTOR FIXED METAL-FILM 56K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-56K-G-T-1
R471	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15K-G-T-1
R472	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R501	24772/070	RESISTOR FIXED METAL-FILM 750R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-750R-G-T-1
R502	24772/070	RESISTOR FIXED METAL-FILM 750R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-750R-G-T-1
R503	24772/070	RESISTOR FIXED METAL-FILM 750R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-750R-G-T-1
R504	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R505	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15K-G-T-1
R506	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R507	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R508	24772/070	RESISTOR FIXED METAL-FILM 750R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-750R-G-T-1
R509	24772/085	RESISTOR FIXED METAL-FILM 3K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K3-G-T-1
R511	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R512	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R513	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R514	24772/117	RESISTOR FIXED METAL-FILM 68K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-68K-G-T-1
R515	24772/141	RESISTOR FIXED METAL-FILM 1M +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/1M-F-T2
R516	24772/093	RESISTOR FIXED METAL-FILM 6K8 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-6K8-G-T-1
R517	24772/093	RESISTOR FIXED METAL-FILM 6K8 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-6K8-G-T-1
R518	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R519	24772/107	RESISTOR FIXED METAL-FILM 27K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-27K-G-T-1
R520	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-47K-G-T-1

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R521	24772/085	RESISTOR FIXED METAL-FILM 3K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K3-G-T-1
R522	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R523	24772/125	RESISTOR FIXED METAL-FILM 150K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150K-G-T-1
R524	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R525	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R526	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R527	24772/123	RESISTOR FIXED METAL-FILM 120K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-120K-G-T-1
R528	24772/125	RESISTOR FIXED METAL-FILM 150K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150K-G-T-1
R529	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R530	24772/117	RESISTOR FIXED METAL-FILM 68K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-68K-G-T-1
R531	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R532	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R533	24772/107	RESISTOR FIXED METAL-FILM 27K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-27K-G-T-1
R534	24772/107	RESISTOR FIXED METAL-FILM 27K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-27K-G-T-1
R535	24772/093	RESISTOR FIXED METAL-FILM 6K8 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-6K8-G-T-1
R536	24772/103	RESISTOR FIXED METAL-FILM 18K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-18K-G-T-1
R537	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R538	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-20K-G-T-1
R539	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R540	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-20K-G-T-1
R541	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R542	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R543	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R544	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R545	24772/107	RESISTOR FIXED METAL-FILM 27K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-27K-G-T-1
R546	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R547	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R548	24772/036	RESISTOR FIXED METAL-FILM 30R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-30R-G-T-1
R549	24772/068	RESISTOR FIXED METAL-FILM 620R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-620R-G-T-1
R550	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R551	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R552	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R601	24773/297	RESISTOR FIXED METAL-FILM 10K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-10K
R603	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R604	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R605	24773/245	RESISTOR FIXED METAL-FILM 68R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-68R
R606	24772/085	RESISTOR FIXED METAL-FILM 3K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K3-G-T-1
R607	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R608	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R609	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R610	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R611	24772/029	RESISTOR FIXED METAL-FILM 15R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15R-G-T-1
R612	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R613	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R614	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R615	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R616	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R617	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R618	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R619	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R620	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R621	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1

AA1/2 Control board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R622	24772/078	RESISTOR FIXED METAL-FILM 1K6 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K6-G-T-1
R623	24772/069	RESISTOR FIXED METAL-FILM 680R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-680R-G-T-1
R624	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R625	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R626	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R627	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R628	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R629	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R630	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R631	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R632	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R636	24772/079	RESISTOR FIXED METAL-FILM 1K8 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K8-G-T-1
R637	24772/066	RESISTOR FIXED METAL-FILM 510R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-510R-G-T-1
R638	24772/079	RESISTOR FIXED METAL-FILM 1K8 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K8-G-T-1
R639	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R640	24772/066	RESISTOR FIXED METAL-FILM 510R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-510R-G-T-1
R641	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R643	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R645	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R646	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R647	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R648	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R649	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R650	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R651	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R652	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R653	24772/036	RESISTOR FIXED METAL-FILM 30R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-30R-G-T-1
R655	24772/101	RESISTOR FIXED METAL-FILM 15K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15K-G-T-1
R657	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT
R658	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT
R659	24321/738	RESISTOR FIXED METAL-GLAZE 36R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-36R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-36R5-FT
R660	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R661	24772/078	RESISTOR FIXED METAL-FILM 1K6 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K6-G-T-1
R662	24772/085	RESISTOR FIXED METAL-FILM 3K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K3-G-T-1
R663	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT
R664	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT
R665	24321/738	RESISTOR FIXED METAL-GLAZE 36R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-36R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-36R5-FT
R666	24772/074	RESISTOR FIXED METAL-FILM 1K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K1-G-T-1
R668	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R669	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R670	24772/074	RESISTOR FIXED METAL-FILM 1K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K1-G-T-1
R671	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R672	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R673	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R674	24772/082	RESISTOR FIXED METAL-FILM 2K4 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K4-G-T-1
R679	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R680	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R681	24772/087	RESISTOR FIXED METAL-FILM 3K9 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K9-G-T-1
R682	24772/087	RESISTOR FIXED METAL-FILM 3K9 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K9-G-T-1
R684	24681/624	RESISTOR NETWORK BUSSED, THICK-FILM, 680R 5% 750mW 50V 500 ppm/DEG.C, 9 RESISTORS, LOW PROFILE, 10	CGS RESISTANCE CO.	108CA2/680R
R685	24681/691	RESISTOR NETWORK BUSSED, THICK-FILM, 3K9 2% 1W 100V 200 ppm/DEG.C, 9 RESISTORS, LOW PROFILE, 10	BOURNS ELECTRONICS	4610X-101-392
R686	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R688	24772/069	RESISTOR FIXED METAL-FILM 680R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-680R-G-T-1
R689	24772/048	RESISTOR FIXED METAL-FILM 91R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-91R-G-T-1
R690	24772/070	RESISTOR FIXED METAL-FILM 750R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-750R-G-T-1
R691	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R692	24772/029	RESISTOR FIXED METAL-FILM 15R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15R-G-T-1
R693	24772/029	RESISTOR FIXED METAL-FILM 15R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15R-G-T-1
R694	24772/029	RESISTOR FIXED METAL-FILM 15R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15R-G-T-1
R695	24772/029	RESISTOR FIXED METAL-FILM 15R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15R-G-T-1
R696	24772/029	RESISTOR FIXED METAL-FILM 15R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15R-G-T-1
R697	24772/029	RESISTOR FIXED METAL-FILM 15R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15R-G-T-1
R698	24772/029	RESISTOR FIXED METAL-FILM 15R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15R-G-T-1
R699	24772/029	RESISTOR FIXED METAL-FILM 15R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-15R-G-T-1
R701	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R702	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R703	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R704	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R705	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R706	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R707	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R708	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R709	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R710	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R721	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R722	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R723	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R724	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
R725	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R726	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R727	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R728	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
RLA	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLB	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLC	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLG	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLH	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLJ	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLK	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLL	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLM	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLN	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
TR301	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR302	28459/071	TRANSISTOR N-CHANNEL-DEPLETION JFET VCR4N.... 15V 300mW VOLTAGE CONTROLLED RESISTOR, TO-18.	SILICONIX LTD	VCR4N
TR303	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR304	28459/071	TRANSISTOR N-CHANNEL-DEPLETION JFET VCR4N.... 15V 300mW VOLTAGE CONTROLLED RESISTOR, TO-18.	SILICONIX LTD	VCR4N
TR305	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR401	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR402	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR403	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR404	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
TR405	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR406	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR407	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR408	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR501	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR601	28452/172	TRANSISTOR NPN BIPOLAR BFR96S.... 15V 5GHz 700mW 100mA 25hFE @ 70mA, SURFACE MOUNTED, SOT-37.	PHILIPS	BFR96S
TR602	28452/172	TRANSISTOR NPN BIPOLAR BFR96S.... 15V 5GHz 700mW 100mA 25hFE @ 70mA, SURFACE MOUNTED, SOT-37.	PHILIPS	BFR96S
TR603	28452/172	TRANSISTOR NPN BIPOLAR BFR96S.... 15V 5GHz 700mW 100mA 25hFE @ 70mA, SURFACE MOUNTED, SOT-37.	PHILIPS	BFR96S
TR604	28452/172	TRANSISTOR NPN BIPOLAR BFR96S.... 15V 5GHz 700mW 100mA 25hFE @ 70mA, SURFACE MOUNTED, SOT-37.	PHILIPS	BFR96S
TR605	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR606	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR607	28452/197	TRANSISTOR NPN BIPOLAR 2N2369.... 15V 500MHz 360mW 500mA 40hFE @ 10mA, TO-18.	MOTOROLA INC.	2N2369
TR608	28452/197	TRANSISTOR NPN BIPOLAR 2N2369.... 15V 500MHz 360mW 500mA 40hFE @ 10mA, TO-18.	MOTOROLA INC.	2N2369
TR609	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR610	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR611	28431/767	TRANSISTOR PNP BIPOLAR MPS4258.... 12V 700MHz 1W 80mA 30hFE @ 50mA, TO-92, (LOOSE).	MOTOROLA INC.	MPS4258
TR612	28431/767	TRANSISTOR PNP BIPOLAR MPS4258.... 12V 700MHz 1W 80mA 30hFE @ 50mA, TO-92, (LOOSE).	MOTOROLA INC.	MPS4258
TR613	28431/767	TRANSISTOR PNP BIPOLAR MPS4258.... 12V 700MHz 1W 80mA 30hFE @ 50mA, TO-92, (LOOSE).	MOTOROLA INC.	MPS4258
TR614	28431/767	TRANSISTOR PNP BIPOLAR MPS4258.... 12V 700MHz 1W 80mA 30hFE @ 50mA, TO-92, (LOOSE).	MOTOROLA INC.	MPS4258
TR615	28487/807	TRANSISTOR NPN BIPOLAR 42085.... 12V 6GHz 500mW 80mA 30hFE @ 35mA, 20dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-42085
TR616	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR617	28452/197	TRANSISTOR NPN BIPOLAR 2N2369.... 15V 500MHz 360mW 500mA 40hFE @ 10mA, TO-18.	MOTOROLA INC.	2N2369
X1	23635/833	CORE BEAD, 4.2mm DIA, 5.5mm LONG, 1.8mm I/DIA, FERRITE, GRADE 3B, SINGLE HOLE.	PHILIPS	FX1115
X2	23635/833	CORE BEAD, 4.2mm DIA, 5.5mm LONG, 1.8mm I/DIA, FERRITE, GRADE 3B, SINGLE HOLE.	PHILIPS	FX1115

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AA1/2 Control board (contd.)				
X3	23635/833	CORE BEAD, 4.2mm DIA, 5.5mm LONG, 1.8mm I/DIA, FERRITE, GRADE 3B, SINGLE HOLE.	PHILIPS	FX1115
X4	23635/833	CORE BEAD, 4.2mm DIA, 5.5mm LONG, 1.8mm I/DIA, FERRITE, GRADE 3B, SINGLE HOLE.	PHILIPS	FX1115
X5	23635/833	CORE BEAD, 4.2mm DIA, 5.5mm LONG, 1.8mm I/DIA, FERRITE, GRADE 3B, SINGLE HOLE.	PHILIPS	FX1115
X6	23635/833	CORE BEAD, 4.2mm DIA, 5.5mm LONG, 1.8mm I/DIA, FERRITE, GRADE 3B, SINGLE HOLE.	PHILIPS	FX1115
X7	23635/833	CORE BEAD, 4.2mm DIA, 5.5mm LONG, 1.8mm I/DIA, FERRITE, GRADE 3B, SINGLE HOLE.	PHILIPS	FX1115
X8	23635/833	CORE BEAD, 4.2mm DIA, 5.5mm LONG, 1.8mm I/DIA, FERRITE, GRADE 3B, SINGLE HOLE.	PHILIPS	FX1115
XL101	28312/100	CRYSTAL 16 MHz +/- 20 ppm, 30pF PARALLEL RESONANCE, 25R ESR MAX, MICROPROCESSOR	STC COMPONENTS LTD	16MHz/20ppm/4703
XL601	44520/002	CRYSTAL 104.857 MHz +/- 10 ppm, SPECIAL-SELECTED, SERIES RESONANCE, 2.3mH - 40R ESR MAX, STYLE QC45	MARCONI INSTRUMENTS LTD	
	43137/339	RF-CABLE FLEXIBLE RG178B/U, 50 OHMS, SMB FEMALE PLAL 104.8576 MHz to PLBM, AB4/1	MARCONI INSTRUMENTS LTD	
	43137/996	RF-CABLE FLEXIBLE RG178B/U, 50 OHMS, SMB FEMALE SKAF to AB1	MARCONI INSTRUMENTS LTD	
	43137/341	RIBBON-LEAD 16 WAY, SOCKET 16 WAY, -DIL PLUG 16 SKAK to AF2/x	MARCONI INSTRUMENTS LTD	
	23435/120	CONNECTOR MULTIWAY, PCB HEADER, 36 WAY, RIGHT PLAJ	DU PONT (UK) LTD	75168-101-36
	23435/121	CONNECTOR MULTIWAY, PCB HEADER, 36 WAY, STRAIGHT, PLAA	MOLEX ELECTRONICS	22-10-2281
	23435/529	CONNECTOR TYPE-57, SOCKET, 24 WAY RIGHT ANGLED, SKAM	AMP (GB) LTD	552791-4
	28488/484	HT/SINK FOR IC101 HEATSINK EXTRUSION 30.5mm LONG, 28mm WIDE,	REDPOINT LTD	LT68

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AB1 VCO board

Issue 20

When ordering, prefix circuit reference with AB1.

	44829/542	Complete unit		
C1	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C2	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C3	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C4	26386/898	CAPACITOR FIXED CERAMIC 5.6pF +/-0.1pF 50V 60 ppm/DEG.C, HIGH-Q, MULTILAYER, SURFACE-MOUNTED,	AVX LTD	0805-5K5R6-BAW-TR
C5	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C6	26386/814	CAPACITOR FIXED CERAMIC 15pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 150 JAT 00 J
C7	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C8	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C9	26386/898	CAPACITOR FIXED CERAMIC 5.6pF +/-0.1pF 50V 60 ppm/DEG.C, HIGH-Q, MULTILAYER, SURFACE-MOUNTED,	AVX LTD	0805-5K5R6-BAW-TR
C10	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C11	26386/814	CAPACITOR FIXED CERAMIC 15pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 150 JAT 00 J
C12	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C13	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C14	26386/897	CAPACITOR FIXED CERAMIC 4.7pF +/-0.1pF 50V 60 ppm/DEG.C, HIGH-Q, MULTILAYER, SURFACE-MOUNTED,	AVX LTD	0805-5K4R7-BAW-TR
C15	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C16	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C17	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C18	26386/808	CAPACITOR FIXED CERAMIC 4.7pF +/-0.5pF 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 4R7 DAT 00 J
C19	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C20	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C21	26386/897	CAPACITOR FIXED CERAMIC 4.7pF +/-0.1pF 50V 60 ppm/DEG.C, HIGH-Q, MULTILAYER, SURFACE-MOUNTED,	AVX LTD	0805-5K4R7-BAW-TR
C22	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C23	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB1	**VCO board (contd.)**			
C24	26343/753	CAPACITOR FIXED CERAMIC 6.8pF +/-0.5pF 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 6R8 DAT 00 J
C25	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C26	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C27	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C28	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C29	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C30	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C31	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C32	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C33	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C34	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C35	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C36	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C37	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C38	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C39	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C40	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C42	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C43	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C44	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C45	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C46	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C47	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C48	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C49	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J
C50	26386/828	CAPACITOR FIXED CERAMIC 220pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 221 JAT 00 J

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB1	**VCO board (contd.)**			
D1	28381/133	DIODE VARIABLE CAPACITNCE, BB515... 30V 11.5pF @ 3V, CAPAC RATIO 8.0 MIN, SURFACE MOUNTED, SOD-123,	SIEMENS LTD	BB515-B
D2	28381/133	DIODE VARIABLE CAPACITNCE, BB515... 30V 11.5pF @ 3V, CAPAC RATIO 8.0 MIN, SURFACE MOUNTED, SOD-123,	SIEMENS LTD	BB515-B
D3	28381/133	DIODE VARIABLE CAPACITNCE, BB515... 30V 11.5pF @ 3V, CAPAC RATIO 8.0 MIN, SURFACE MOUNTED, SOD-123,	SIEMENS LTD	BB515-B
D4	28381/133	DIODE VARIABLE CAPACITNCE, BB515... 30V 11.5pF @ 3V, CAPAC RATIO 8.0 MIN, SURFACE MOUNTED, SOD-123,	SIEMENS LTD	BB515-B
D5	28383/961	DIODE PIN, BAR16-1... DUAL, 140mW 100V 100mA 0.5pF 1.25Vf @ 100mA, COMMON ANODE, MARKING CODE L9,	SIEMENS LTD	BAR16-1
D6	28383/910	DIODE SMALL-SIGNAL, BAS28... DUAL, 330mW 75V 250mA ELECTRICALLY ISOLATED, MARKING CODE A61 OR JT,	PHILIPS	BAS28
D7	28383/910	DIODE SMALL-SIGNAL, BAS28... DUAL, 330mW 75V 250mA ELECTRICALLY ISOLATED, MARKING CODE A61 OR JT,	PHILIPS	BAS28
IC1	28469/756	IC ANALOGUE MULTIPLEXER 74HC4051.. SINGLE, 8 CHANNEL, 3 SELECT INPUTS PLUS ENABLE,	HARRIS SEMICONDUCTOR	CD74HC4051M
IC2	28461/419	IC ANALOGUE MICROWAVE-AMPLIFIER MSA-0285... 5V 25mA GAIN 12dB @ 1.0GHz, 3dB BANDWIDTH DC -	AVANTEK (US) INC	MSA-0285
IC3	28461/419	IC ANALOGUE MICROWAVE-AMPLIFIER MSA-0285... 5V 25mA GAIN 12dB @ 1.0GHz, 3dB BANDWIDTH DC -	AVANTEK (US) INC	MSA-0285
IC4	28461/419	IC ANALOGUE MICROWAVE-AMPLIFIER MSA-0285... 5V 25mA GAIN 12dB @ 1.0GHz, 3dB BANDWIDTH DC -	AVANTEK (US) INC	MSA-0285
IC5	28461/419	IC ANALOGUE MICROWAVE-AMPLIFIER MSA-0285... 5V 25mA GAIN 12dB @ 1.0GHz, 3dB BANDWIDTH DC -	AVANTEK (US) INC	MSA-0285
L1	44291/017	WOUND-PART INDUCTOR, BEAD-CORE, 7 TURNS, UNMOUNTED, VARNISHED.	AMETHYST DESIGNS LTD	AD5033
L2	44291/017	WOUND-PART INDUCTOR, BEAD-CORE, 7 TURNS, UNMOUNTED, VARNISHED.	AMETHYST DESIGNS LTD	AD5033
L3	44291/017	WOUND-PART INDUCTOR, BEAD-CORE, 7 TURNS, UNMOUNTED, VARNISHED.	AMETHYST DESIGNS LTD	AD5033
L4	44291/017	WOUND-PART INDUCTOR, BEAD-CORE, 7 TURNS, UNMOUNTED, VARNISHED.	AMETHYST DESIGNS LTD	AD5033
R1	24321/804	RESISTOR FIXED METAL-GLAZE 20K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-20K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2002-FT
R2	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R3	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R4	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R5	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB1	**VCO board (contd.)**			
R6	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R7	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R8	24321/604	RESISTOR FIXED METAL-GLAZE 10R +/- 5% 60mW 100V 200 ppm/DEG.C, SURFACE MOUNTED, SIZE 0805, (LOOSE	DALE ELECTROSIL LTD	CRCW-0805-100-JT1
R9	24331/997	RESISTOR FIXED CARBON-COMPOSITION 100R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1015
R10	24321/604	RESISTOR FIXED METAL-GLAZE 10R +/- 5% 60mW 100V 200 ppm/DEG.C, SURFACE MOUNTED, SIZE 0805, (LOOSE	DALE ELECTROSIL LTD	CRCW-0805-100-JT1
R11	24331/997	RESISTOR FIXED CARBON-COMPOSITION 100R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1015
R12	24321/604	RESISTOR FIXED METAL-GLAZE 10R +/- 5% 60mW 100V 200 ppm/DEG.C, SURFACE MOUNTED, SIZE 0805, (LOOSE	DALE ELECTROSIL LTD	CRCW-0805-100-JT1
R13	24331/997	RESISTOR FIXED CARBON-COMPOSITION 100R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1015
R14	24321/604	RESISTOR FIXED METAL-GLAZE 10R +/- 5% 60mW 100V 200 ppm/DEG.C, SURFACE MOUNTED, SIZE 0805, (LOOSE	DALE ELECTROSIL LTD	CRCW-0805-100-JT1
R15	24331/997	RESISTOR FIXED CARBON-COMPOSITION 100R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1015
R16	24321/604	RESISTOR FIXED METAL-GLAZE 10R +/- 5% 60mW 100V 200 ppm/DEG.C, SURFACE MOUNTED, SIZE 0805, (LOOSE	DALE ELECTROSIL LTD	CRCW-0805-100-JT1
R17	24331/997	RESISTOR FIXED CARBON-COMPOSITION 100R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1015
R18	24321/606	RESISTOR FIXED METAL-GLAZE 20R +/- 5% 60mW 100V 200 ppm/DEG.C, SURFACE MOUNTED, SIZE 0805, (LOOSE	DALE ELECTROSIL LTD	CRCW-0805-200-JRT1
R19	24321/604	RESISTOR FIXED METAL-GLAZE 10R +/- 5% 60mW 100V 200 ppm/DEG.C, SURFACE MOUNTED, SIZE 0805, (LOOSE	DALE ELECTROSIL LTD	CRCW-0805-100-JT1
R20	24331/997	RESISTOR FIXED CARBON-COMPOSITION 100R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1015
R21	24331/997	RESISTOR FIXED CARBON-COMPOSITION 100R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1015
R22	24321/605	RESISTOR FIXED METAL-GLAZE 15R +/- 5% 60mW 100V 200 ppm/DEG.C, SURFACE MOUNTED, SIZE 0805, (LOOSE	DALE ELECTROSIL LTD	CRCW-0805-150-JRT1
R23	24331/997	RESISTOR FIXED CARBON-COMPOSITION 100R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1015
R24	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R25	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R26	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R27	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R28	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R29	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT
R30	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT
R31	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB1	**VCO board (contd.)**			
R32	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R33	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R34	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R35	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT
R36	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT
R37	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT
R38	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT
R39	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT
R40	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT
R41	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R42	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
TR1	28487/809	TRANSISTOR NPN BIPOLAR BFR93A... 12V 5GHz 250mW 35mA MARKING CODE R2, SURFACE MOUNTED, SOT-23,	PHILIPS	BFR93A
TR2	28487/809	TRANSISTOR NPN BIPOLAR BFR93A... 12V 5GHz 250mW 35mA MARKING CODE R2, SURFACE MOUNTED, SOT-23,	PHILIPS	BFR93A
TR3	28487/809	TRANSISTOR NPN BIPOLAR BFR93A... 12V 5GHz 250mW 35mA MARKING CODE R2, SURFACE MOUNTED, SOT-23,	PHILIPS	BFR93A
TR4	28487/809	TRANSISTOR NPN BIPOLAR BFR93A... 12V 5GHz 250mW 35mA MARKING CODE R2, SURFACE MOUNTED, SOT-23,	PHILIPS	BFR93A
TR5	28487/810	TRANSISTOR NPN BIPOLAR BSV52... 12V 400MHz 250mW 100mA MARKING CODE B2, SURFACE MOUNTED, SOT-23,	PHILIPS	BSV-52
TR6	28487/810	TRANSISTOR NPN BIPOLAR BSV52... 12V 400MHz 250mW 100mA MARKING CODE B2, SURFACE MOUNTED, SOT-23,	PHILIPS	BSV-52
TR7	28487/810	TRANSISTOR NPN BIPOLAR BSV52... 12V 400MHz 250mW 100mA MARKING CODE B2, SURFACE MOUNTED, SOT-23,	PHILIPS	BSV-52
TR8	28487/810	TRANSISTOR NPN BIPOLAR BSV52... 12V 400MHz 250mW 100mA MARKING CODE B2, SURFACE MOUNTED, SOT-23,	PHILIPS	BSV-52
	43137/344	RIBBON-LEAD 10 WAY, SOCKET 10 WAY, KEY POS 5, - SKBC to PLBF, AB2/2	MARCONI INSTRUMENTS LTD	

AB2/2 RF board

Issue 20

When ordering, prefix circuit reference with AB2/2.

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
	44829/791	Complete unit		
C1	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C2	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C3	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C4	26343/487	CAPACITOR FIXED CERAMIC 6.8pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09688
C5	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C6	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C7	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C8	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C9	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C10	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C11	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C12	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C13	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C14	26343/488	CAPACITOR FIXED CERAMIC 8.2pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09828
C15	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C16	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C17	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C18	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C19	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C20	26343/487	CAPACITOR FIXED CERAMIC 6.8pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09688
C21	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C22	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C23	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
C24	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C25	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C26	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C27	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C28	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C29	26421/142	CAPACITOR FIXED ALUMINIUM 220uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	16TWSS220M (TAPE)
C30	26421/142	CAPACITOR FIXED ALUMINIUM 220uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	16TWSS220M (TAPE)
C31	26486/225	CAPACITOR FIXED TANTALUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-G-3-10-10-M-FSPB
C32	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C34	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C35	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C36	26421/124	CAPACITOR FIXED ALUMINIUM 220uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, 13mm HIGH MAX,	RUBYCON CAPACITORS	16 TWMS 220 M
C37	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C38	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C39	26343/434	CAPACITOR FIXED CERAMIC 68pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34689
C40	26343/434	CAPACITOR FIXED CERAMIC 68pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34689
C41	26538/912	CAPACITOR FIXED POLYSTYRENE 2.7nF +/-1% 63V 125 ppm/DEG.C, RADIAL, 5.08mm PWP, SQUARE, WIRES ON	RIC CAPACITORS	A635/2700pF-1%-63V
C42	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C43	26421/124	CAPACITOR FIXED ALUMINIUM 220uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, 13mm HIGH MAX,	RUBYCON CAPACITORS	16 TWMS 220 M
C44	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C45	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C46	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C47	26421/122	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	35 TWMS 100 M
C48	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C49	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C50	26343/492	CAPACITOR FIXED CERAMIC 10pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10109

AB2/2 RF board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C51	26343/497	CAPACITOR FIXED CERAMIC 12pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10129
C52	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C53	26421/116	CAPACITOR FIXED ALUMINIUM 47uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16-MS7-47-M
C55	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C56	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C57	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C58	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
C59	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C60	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C62	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C63	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C64	26582/439	CAPACITOR FIXED POLYESTER 680nF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0684 KDC
C65	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C66	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C67	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C68	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C69	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C70	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C71	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C72	26486/214	CAPACITOR FIXED TANTALUM 2.2uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-G-3-05-2.2-M-FSPB
C73	26486/225	CAPACITOR FIXED TANTALUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-G-3-10-10-M-FSPB
C74	26343/487	CAPACITOR FIXED CERAMIC 6.8pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09688
C81	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C84	26582/439	CAPACITOR FIXED POLYESTER 680nF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0684 KDC
C85	26582/439	CAPACITOR FIXED POLYESTER 680nF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0684 KDC
C86	26582/439	CAPACITOR FIXED POLYESTER 680nF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0684 KDC

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
C88	26343/434	CAPACITOR FIXED CERAMIC 68pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34689
C89	26343/487	CAPACITOR FIXED CERAMIC 6.8pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09688
C91	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
C97	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C99	26343/432	CAPACITOR FIXED CERAMIC 150pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34151
C100	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C101	26383/581	CAPACITOR FIXED CERAMIC 560pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51561
C102	26383/581	CAPACITOR FIXED CERAMIC 560pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51561
C103	26383/581	CAPACITOR FIXED CERAMIC 560pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51561
C104	26383/581	CAPACITOR FIXED CERAMIC 560pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51561
C105	26343/491	CAPACITOR FIXED CERAMIC 2.2pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09228
C106	26386/804	CAPACITOR FIXED CERAMIC 2.2pF +/-0.5pF 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 2R2 DAT 00 J
C107	26383/581	CAPACITOR FIXED CERAMIC 560pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51561
C108	26383/581	CAPACITOR FIXED CERAMIC 560pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51561
C109	26343/753	CAPACITOR FIXED CERAMIC 6.8pF +/-0.5pF 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 6R8 DAT 00 J
C110	26343/757	CAPACITOR FIXED CERAMIC 3.3pF +/-0.5pF 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 3R3 DAT 00 J
C111	26383/581	CAPACITOR FIXED CERAMIC 560pF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51561
C112	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C113	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C114	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C115	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C116	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C117	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C118	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C119	26343/494	CAPACITOR FIXED CERAMIC 33pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34339
C120	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229

AB2/2 RF board (contd.)

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C121	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C122	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C123	26343/430	CAPACITOR FIXED CERAMIC 39pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34399
C124	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C125	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C126	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C127	26343/498	CAPACITOR FIXED CERAMIC 18pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10189
C128	26343/492	CAPACITOR FIXED CERAMIC 10pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10109
C129	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C130	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C131	26343/499	CAPACITOR FIXED CERAMIC 27pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34279
C132	26343/430	CAPACITOR FIXED CERAMIC 39pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34399
C133	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C134	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C135	26343/444	CAPACITOR FIXED CERAMIC 56pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34569
C136	26343/444	CAPACITOR FIXED CERAMIC 56pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34569
C137	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C138	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C139	26343/431	CAPACITOR FIXED CERAMIC 82pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34829
C140	26343/444	CAPACITOR FIXED CERAMIC 56pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34569
C141	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C142	26343/430	CAPACITOR FIXED CERAMIC 39pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34399
C143	26343/434	CAPACITOR FIXED CERAMIC 68pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34689
C144	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C153	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C154	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
C155	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C160	26343/502	CAPACITOR FIXED CERAMIC 1pF +/-0.5pF 63V P100 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	STC COMPONENTS LTD	ED1B-P100-1-D-PU1
C163	26343/502	CAPACITOR FIXED CERAMIC 1pF +/-0.5pF 63V P100 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	STC COMPONENTS LTD	ED1B-P100-1-D-PU1
C168	26383/587	CAPACITOR FIXED CERAMIC 2.2nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51222
C169	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C174	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C175	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C176	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C201	26421/118	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	6.3-MS7-100-M
C301	26421/126	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16 TWSS 470 M
C302	26421/126	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16 TWSS 470 M
C303	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C304	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C306	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C307	26343/438	CAPACITOR FIXED CERAMIC 120pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34121
C308	26343/444	CAPACITOR FIXED CERAMIC 56pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34569
C309	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C310	26386/818	CAPACITOR FIXED CERAMIC 33pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 330 JAT 00 J
C311	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C312	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C313	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C314	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C320	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C321	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C322	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C324	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J

Clr Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
C325	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C326	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C327	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C328	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C329	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C330	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C331	26383/017	CAPACITOR FIXED CERAMIC 47nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD306-979F-473-Z-25
C332	26386/863	CAPACITOR FIXED CERAMIC 1nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 102 KAT 00 J
C334	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C335	26386/863	CAPACITOR FIXED CERAMIC 1nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 102 KAT 00 J
C336	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C337	26386/819	CAPACITOR FIXED CERAMIC 39pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 390 JAT 00 J
C338	26386/819	CAPACITOR FIXED CERAMIC 39pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 390 JAT 00 J
C339	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C340	26386/819	CAPACITOR FIXED CERAMIC 39pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 390 JAT 00 J
C341	26386/814	CAPACITOR FIXED CERAMIC 15pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 150 JAT 00 J
C342	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C343	26386/814	CAPACITOR FIXED CERAMIC 15pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 150 JAT 00 J
C344	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C345	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C346	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C347	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C401	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C402	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C403	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C404	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
C405	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C407	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C408	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C409	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C410	26386/800	CAPACITOR FIXED CERAMIC 1pF +/-0.5pF 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 1R0 DAT 00 J
C420	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C421	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
D1	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
D2	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D3	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D4	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D5	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D6	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
D7	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
D8	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
D9	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
D10	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
D11	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
D12	28383/963	DIODE PIN, 1N5719... 250mW 150V 0.3pF AXIAL, HP-OUTLINE-15, (LOOSE).	HEWLETT-PACKARD	1N5719
D13	28383/963	DIODE PIN, 1N5719... 250mW 150V 0.3pF AXIAL, HP-OUTLINE-15, (LOOSE).	HEWLETT-PACKARD	1N5719
D14	28383/963	DIODE PIN, 1N5719... 250mW 150V 0.3pF AXIAL, HP-OUTLINE-15, (LOOSE).	HEWLETT-PACKARD	1N5719
D15	28383/963	DIODE PIN, 1N5719... 250mW 150V 0.3pF AXIAL, HP-OUTLINE-15, (LOOSE).	HEWLETT-PACKARD	1N5719
D17	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D18	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148

AB2/2 RF board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
D19	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D20	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D21	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D22	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D23	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D24	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D25	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D26	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D27	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D28	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D29	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D100	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D101	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D102	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D103	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D104	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D105	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D106	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D107	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D108	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D109	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D110	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D113	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D114	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D115	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D116	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482

AB2/2 RF board (contd.)

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
D117	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D118	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D119	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D120	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D121	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D122	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D123	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D124	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D125	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D126	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D127	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D128	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D129	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D130	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D131	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D132	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D133	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D134	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D140	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D141	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D142	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D143	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D144	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D145	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D146	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D148	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
D153	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D154	28335/675	DIODE BAND SWITCHING, BA482... 35V 100mA 1.2Vf @ 100mA, AXIAL, DO-34, (TAPED).	PHILIPS	BA482
D300	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D301	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D302	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D303	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D304	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D305	28349/022	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2812... DUAL, 20V 1A 0.41Vf @ 1mA, MARKED B2, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2812-L31
D306	28349/022	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2812... DUAL, 20V 1A 0.41Vf @ 1mA, MARKED B2, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2812-L31
D307	28371/371	DIODE ZENER, BZX79-C4V7... 500mW 4.7V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C4V7
D308	28371/371	DIODE ZENER, BZX79-C4V7... 500mW 4.7V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C4V7
D309	28371/371	DIODE ZENER, BZX79-C4V7... 500mW 4.7V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C4V7
D401	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
D402	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
IC1	28466/378	IC DIGITAL NAND-BUFFER 74F38... 2 INPUT, QUAD, OPEN-COLLECTOR, TTL-SCHOTTKY-FAST, 14 PIN,	PHILIPS	N74F38N
IC2	44529/115	IC DIGITAL DIVIDER MARKED 44529/115, 5 STAGE BINARY, PROGRAMMABLE, 1.5GHz, PACKED IN BOXES OF	MTL MICROTECH	£
IC3	28461/349	IC ANALOGUE OPERATIONAL AMP TL074CN... QUAD, JFET-INPUT, LINEAR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL074CN
IC4	28461/348	IC ANALOGUE OPERATIONAL AMP TL072CP... DUAL, JFET-INPUT, LINEAR, 8 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL072CP
IC5	28461/349	IC ANALOGUE OPERATIONAL AMP TL074CN... QUAD, JFET-INPUT, LINEAR, 14 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL074CN
IC6	28461/410	IC ANALOGUE MICROWAVE-AMPLIFIER MSA-0485.. 5.25V 50mA GAIN 8.0dB @ 1GHz, 3dB BANDWIDTH DC - 3.6GHz,	MINI-CIRCUITS	MAR-4
IC7	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC8	28467/536	IC DIGITAL SHIFT-REGISTER 74HC166... 8 BIT, PARALLEL-IN SERIAL-OUT, CMOS-H/SPEED, 16 PIN,	HARRIS SEMICONDUCTOR	CD74HC166E
IC9	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC10	28461/310	IC ANALOGUE OPERATIONAL AMP 748... GENERAL-PURPOSE, LINEAR, 8 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	LM748CN
IC11	28461/978	IC ANALOGUE SWITCH DG411... QUAD, 5V SPST, CMOS, 16 PIN, DUAL-IN-LINE.	SILICONIX LTD	DG411DJ

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
IC100	28461/410	IC ANALOGUE MICROWAVE-AMPLIFIER MSA-0485.. 5.25V 50mA GAIN 8.0dB @ 1GHz, 3dB BANDWIDTH DC - 3.6GHz,	MINI-CIRCUITS	MAR-4
IC101	28465/050	IC DIGITAL DECODER 74LS145... BCD TO DECIMAL, OPEN-COLLECTOR, TTL-SCHOTTKY-L/PWR, 16 PIN,	MOTOROLA INC.	SN74LS145N
IC102	28465/050	IC DIGITAL DECODER 74LS145... BCD TO DECIMAL, OPEN-COLLECTOR, TTL-SCHOTTKY-L/PWR, 16 PIN,	MOTOROLA INC.	SN74LS145N
IC300	28466/364	IC DIGITAL NAND-GATE 74HC132.. 2 INPUT, QUAD, SCHMITT TRIGGER, CMOS-H/SPEED, 14 PIN,	HARRIS SEMICONDUCTOR	CD74HC132E
IC301	28531/034	MODULE SWITCH, MICROWAVE, DC - 1.5GHz, UNDRIVEN SPST, ISOLATION 80dB @ 1.5GHz, ABSORPTIVE,	M/A COM LTD	DC1/1189/49 issue C
IC302	28469/738	IC ANALOGUE MULTIPLEXER 74HC4052.. DUAL, 4 CHANNEL, 2 SELECT INPUTS PLUS ENABLE,	HARRIS SEMICONDUCTOR	CD74HC4052E
IC401	28461/347	IC ANALOGUE OPERATIONAL AMP TL071CP... SINGLE, JFET-INPUT, LINEAR, 8 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL071CP
L1	23642/551	INDUCTOR FIXED 2.2uH +/- 10% COATED-LACQUER, MINIATURE, 470mA 0R9 MAX, 32 Q @ 7.9 MHz, 140 MHz	SIGMA PRODUCTS LTD	10-10-0517-10
L2	23642/551	INDUCTOR FIXED 2.2uH +/- 10% COATED-LACQUER, MINIATURE, 470mA 0R9 MAX, 32 Q @ 7.9 MHz, 140 MHz	SIGMA PRODUCTS LTD	10-10-0517-10
L3	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L5	23642/551	INDUCTOR FIXED 2.2uH +/- 10% COATED-LACQUER, MINIATURE, 470mA 0R9 MAX, 32 Q @ 7.9 MHz, 140 MHz	SIGMA PRODUCTS LTD	10-10-0517-10
L6	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L7	23642/551	INDUCTOR FIXED 2.2uH +/- 10% COATED-LACQUER, MINIATURE, 470mA 0R9 MAX, 32 Q @ 7.9 MHz, 140 MHz	SIGMA PRODUCTS LTD	10-10-0517-10
L8	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L10	23642/551	INDUCTOR FIXED 2.2uH +/- 10% COATED-LACQUER, MINIATURE, 470mA 0R9 MAX, 32 Q @ 7.9 MHz, 140 MHz	SIGMA PRODUCTS LTD	10-10-0517-10
L11	23642/481	INDUCTOR FIXED 0.15uH +/- 10% MOULDED-EPOXY, 2.45A 0R3 MAX, 50 Q @ 25 MHz, 525 MHz SRF, AXIAL,	SIGMA PRODUCTS LTD	15-10-1003-10 (TAPE)
L12	23642/481	INDUCTOR FIXED 0.15uH +/- 10% MOULDED-EPOXY, 2.45A 0R3 MAX, 50 Q @ 25 MHz, 525 MHz SRF, AXIAL,	SIGMA PRODUCTS LTD	15-10-1003-10 (TAPE)
L13	23642/551	INDUCTOR FIXED 2.2uH +/- 10% COATED-LACQUER, MINIATURE, 470mA 0R9 MAX, 32 Q @ 7.9 MHz, 140 MHz	SIGMA PRODUCTS LTD	10-10-0517-10
L15	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L16	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L17	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L18	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L20	23642/426	INDUCTOR FIXED 0.33uH +/- 10% MOULDED-EPOXY, MINIATURE, 750mA 0R22 MAX, 30 Q @ 25 MHz, 380 MHz	SIGMA PRODUCTS LTD	30-10-2507-10
L21	23642/566	INDUCTOR FIXED 680uH +/- 10% COATED-LACQUER, MINIATURE, 78mA 33R MAX, 45 Q @ 0.79 MHz, 2.5 MHz	SIGMA PRODUCTS LTD	10-10-0547-10
L100	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20

AB2/2 RF board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
L101	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L103	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L104	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L107	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L108	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L111	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L112	23642/556	INDUCTOR FIXED 15uH +/- 10% COATED-LACQUER, MINIATURE, 370mA 1R5 MAX, 55 Q @ 2.5 MHz, 30 MHz	SIGMA PRODUCTS LTD	10-10-0527-10
L114	23642/556	INDUCTOR FIXED 15uH +/- 10% COATED-LACQUER, MINIATURE, 370mA 1R5 MAX, 55 Q @ 2.5 MHz, 30 MHz	SIGMA PRODUCTS LTD	10-10-0527-10
L117	23642/556	INDUCTOR FIXED 15uH +/- 10% COATED-LACQUER, MINIATURE, 370mA 1R5 MAX, 55 Q @ 2.5 MHz, 30 MHz	SIGMA PRODUCTS LTD	10-10-0527-10
L119	23642/556	INDUCTOR FIXED 15uH +/- 10% COATED-LACQUER, MINIATURE, 370mA 1R5 MAX, 55 Q @ 2.5 MHz, 30 MHz	SIGMA PRODUCTS LTD	10-10-0527-10
L122	23642/556	INDUCTOR FIXED 15uH +/- 10% COATED-LACQUER, MINIATURE, 370mA 1R5 MAX, 55 Q @ 2.5 MHz, 30 MHz	SIGMA PRODUCTS LTD	10-10-0527-10
L124	23642/556	INDUCTOR FIXED 15uH +/- 10% COATED-LACQUER, MINIATURE, 370mA 1R5 MAX, 55 Q @ 2.5 MHz, 30 MHz	SIGMA PRODUCTS LTD	10-10-0527-10
L127	23642/556	INDUCTOR FIXED 15uH +/- 10% COATED-LACQUER, MINIATURE, 370mA 1R5 MAX, 55 Q @ 2.5 MHz, 30 MHz	SIGMA PRODUCTS LTD	10-10-0527-10
L132	23642/559	INDUCTOR FIXED 47uH +/- 10% COATED-LACQUER, MINIATURE, 140mA 9R6 MAX, 55 Q @ 2.5 MHz, 15 MHz	SIGMA PRODUCTS LTD	10-10-0533-10
L134	23642/559	INDUCTOR FIXED 47uH +/- 10% COATED-LACQUER, MINIATURE, 140mA 9R6 MAX, 55 Q @ 2.5 MHz, 15 MHz	SIGMA PRODUCTS LTD	10-10-0533-10
L137	23642/559	INDUCTOR FIXED 47uH +/- 10% COATED-LACQUER, MINIATURE, 140mA 9R6 MAX, 55 Q @ 2.5 MHz, 15 MHz	SIGMA PRODUCTS LTD	10-10-0533-10
L138	23642/481	INDUCTOR FIXED 0.15uH +/- 10% MOULDED-EPOXY, 2.45A 0R3 MAX, 50 Q @ 25 MHz, 525 MHz SRF, AXIAL,	SIGMA PRODUCTS LTD	15-10-1003-10 (TAPE)
L139	23642/559	INDUCTOR FIXED 47uH +/- 10% COATED-LACQUER, MINIATURE, 140mA 9R6 MAX, 55 Q @ 2.5 MHz, 15 MHz	SIGMA PRODUCTS LTD	10-10-0533-10
L142	23642/559	INDUCTOR FIXED 47uH +/- 10% COATED-LACQUER, MINIATURE, 140mA 9R6 MAX, 55 Q @ 2.5 MHz, 15 MHz	SIGMA PRODUCTS LTD	10-10-0533-10
L143	23642/424	INDUCTOR FIXED 0.22uH +/- 10% MOULDED-EPOXY, MINIATURE, 940mA 0R14 MAX, 33 Q @ 25 MHz, 470 MHz	SIGMA PRODUCTS LTD	30-10-2505-10
L144	23642/559	INDUCTOR FIXED 47uH +/- 10% COATED-LACQUER, MINIATURE, 140mA 9R6 MAX, 55 Q @ 2.5 MHz, 15 MHz	SIGMA PRODUCTS LTD	10-10-0533-10
L147	23642/559	INDUCTOR FIXED 47uH +/- 10% COATED-LACQUER, MINIATURE, 140mA 9R6 MAX, 55 Q @ 2.5 MHz, 15 MHz	SIGMA PRODUCTS LTD	10-10-0533-10
L301	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L310	23642/423	INDUCTOR FIXED 10uH +/- 10% MOULDED-EPOXY, MINIATURE, 180mA 3R7 MAX, 55 Q @ 7.9 MHz, 46 MHz	SIGMA PRODUCTS LTD	30-10-2525-10
L312	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L313	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
L314	23642/909	WOUND-PART INDUCTOR, WIDEBAND HF CHOKE, BEAD-CORE, 4B1 GRADE MATERIAL, 2.5 TURNS, TINNED COPPER WIRE.	PHILIPS	4312-020-36700
L315	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L401	23642/423	INDUCTOR FIXED 10uH +/- 10% MOULDED-EPOXY, MINIATURE, 180mA 3R7 MAX, 55 Q @ 7.9 MHz, 46 MHz	SIGMA PRODUCTS LTD	30-10-2525-10
R1	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R2	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R3	24772/087	RESISTOR FIXED METAL-FILM 3K9 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K9-G-T-1
R4	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R5	24772/087	RESISTOR FIXED METAL-FILM 3K9 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K9-G-T-1
R6	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R7	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R8	24772/090	RESISTOR FIXED METAL-FILM 5K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-5K1-G-T-1
R9	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R10	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R11	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R12	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R13	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R14	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R15	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R16	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R17	24321/731	RESISTOR FIXED METAL-GLAZE 18R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-18R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-18R2-FT
R18	24772/059	RESISTOR FIXED METAL-FILM 270R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-270R-G-T-1
R19	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R20	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-1K
R21	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1

AB2/2 RF board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R22	24772/063	RESISTOR FIXED METAL-FILM 390R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-390R-G-T-1
R23	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R24	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R25	24573/056	RESISTOR FIXED METAL-OXIDE 200R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-200R-2%
R26	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R27	24773/263	RESISTOR FIXED METAL-FILM 390R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-390R
R28	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R29	24773/251	RESISTOR FIXED METAL-FILM 120R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-120R
R30	24573/067	RESISTOR FIXED METAL-OXIDE 560R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-560R-2%
R31	24772/066	RESISTOR FIXED METAL-FILM 510R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-510R-G-T-1
R32	24772/034	RESISTOR FIXED METAL-FILM 24R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-24R-G-T-1
R33	24753/653	RESISTOR FIXED METAL-FILM 50R +/- 0.5% 250mW 200V 50 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	CE/410-0/50R-D-T2
R34	24723/481	RESISTOR FIXED METAL-FILM 50R39 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (TAPED).	HOLSWORTHY ELEC. LTD	H8-50R39+/-0.1%50PPM
R35	24723/481	RESISTOR FIXED METAL-FILM 50R39 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (TAPED).	HOLSWORTHY ELEC. LTD	H8-50R39+/-0.1%50PPM
R36	24723/487	RESISTOR FIXED METAL-FILM 6K4 +/- 0.1% 250mW 200V 50 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	HOLSWORTHY ELEC. LTD	H8-6K4 +/-0.1% 50PPM
R37	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-22K-G-T-1
R38	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R39	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R40	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R41	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-20K-G-T-1
R42	24772/108	RESISTOR FIXED METAL-FILM 30K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-30K-G-T-1
R43	24772/099	RESISTOR FIXED METAL-FILM 12K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-12K-G-T-1
R44	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R45	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R46	24772/098	RESISTOR FIXED METAL-FILM 11K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-11K-G-T-1
R47	24772/098	RESISTOR FIXED METAL-FILM 11K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-11K-G-T-1

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
R48	24772/104	RESISTOR FIXED METAL-FILM 20K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-20K-G-T-1
R49	24772/137	RESISTOR FIXED METAL-FILM 470K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/475K-F-T2
R50	24772/116	RESISTOR FIXED METAL-FILM 62K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-62K-G-T-1
R51	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R52	24772/116	RESISTOR FIXED METAL-FILM 62K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-62K-G-T-1
R53	24772/137	RESISTOR FIXED METAL-FILM 470K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/475K-F-T2
R54	24772/084	RESISTOR FIXED METAL-FILM 3K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K-G-T-1
R55	24772/077	RESISTOR FIXED METAL-FILM 1K5 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K5-G-T-1
R56	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R57	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R58	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R59	24772/116	RESISTOR FIXED METAL-FILM 62K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-62K-G-T-1
R60	24772/137	RESISTOR FIXED METAL-FILM 470K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/475K-F-T2
R61	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R62	24772/084	RESISTOR FIXED METAL-FILM 3K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K-G-T-1
R63	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R64	24772/025	RESISTOR FIXED METAL-FILM 10R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10R-G-T-1
R65	24772/056	RESISTOR FIXED METAL-FILM 200R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-200R-G-T-1
R66	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R67	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R69	24773/263	RESISTOR FIXED METAL-FILM 390R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-390R
R70	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R71	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R72	24772/092	RESISTOR FIXED METAL-FILM 6K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-6K2-G-T-1
R73	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-33K-G-T-1
R74	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1

AB2/2 RF board (contd.)

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R75	24772/087	RESISTOR FIXED METAL-FILM 3K9 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K9-G-T-1
R76	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R77	24773/246	RESISTOR FIXED METAL-FILM 75R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-75R
R78	24772/085	RESISTOR FIXED METAL-FILM 3K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K3-G-T-1
R79	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R80	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R81	24772/075	RESISTOR FIXED METAL-FILM 1K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K2-G-T-1
R82	24772/077	RESISTOR FIXED METAL-FILM 1K5 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K5-G-T-1
R83	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R84	24772/063	RESISTOR FIXED METAL-FILM 390R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-390R-G-T-1
R85	24681/521	RESISTOR NETWORK ISOLATED, THICK-FILM, 1K 2% 1.5W 500 ppm/DEG.C, 8 RESISTORS, LOW PROFILE, 16 PIN,	ALLEN-BRADLEY ELECT.	316B102
R86	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-47K-G-T-1
R87	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-47K-G-T-1
R88	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-47K-G-T-1
R89	24772/113	RESISTOR FIXED METAL-FILM 47K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-47K-G-T-1
R90	24772/056	RESISTOR FIXED METAL-FILM 200R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-200R-G-T-1
R91	24681/521	RESISTOR NETWORK ISOLATED, THICK-FILM, 1K 2% 1.5W 500 ppm/DEG.C, 8 RESISTORS, LOW PROFILE, 16 PIN,	ALLEN-BRADLEY ELECT.	316B102
R92	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R93	24321/730	RESISTOR FIXED METAL-GLAZE 16R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-16R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-16R2-FT
R94	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R95	24772/058	RESISTOR FIXED METAL-FILM 240R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-240R-G-T-1
R96	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R97	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R98	24772/084	RESISTOR FIXED METAL-FILM 3K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K-G-T-1
R99	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R100	24573/055	RESISTOR FIXED METAL-OXIDE 180R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	WELWYN ELECTRONICS	MFR5-180R-2%

Clr. Ref.	Mi part number	Description	Manufacturer	Manufacturer's part no.
AB2/2	**RF board (contd.)**			
R101	24773/273	RESISTOR FIXED METAL-FILM 1K +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-1K
R102	24321/777	RESISTOR FIXED METAL-GLAZE 1K5 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K50-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1501-FT
R103	24772/026	RESISTOR FIXED METAL-FILM 11R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	CMF51-11R-G-T-1
R104	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R105	24772/026	RESISTOR FIXED METAL-FILM 11R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	CMF51-11R-G-T-1
R107	24772/050	RESISTOR FIXED METAL-FILM 110R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-110R-G-T-1
R111	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R112	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R113	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R114	24772/075	RESISTOR FIXED METAL-FILM 1K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K2-G-T-1
R115	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R116	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R200	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R206	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R207	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R208	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R209	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R210	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R265	24773/265	RESISTOR FIXED METAL-FILM 470R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-470R
R300	24773/265	RESISTOR FIXED METAL-FILM 470R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-470R
R301	24773/225	RESISTOR FIXED METAL-FILM 10R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-10R
R306	24772/075	RESISTOR FIXED METAL-FILM 1K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K2-G-T-1
R308	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R309	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R310	24773/249	RESISTOR FIXED METAL-FILM 100R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-100R
R311	24773/249	RESISTOR FIXED METAL-FILM 100R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-100R

AB2/2 RF board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R312	24772/081	RESISTOR FIXED METAL-FILM 2K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K2-G-T-1
R320	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R321	24772/094	RESISTOR FIXED METAL-FILM 7K5 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-7K5-G-T-1
R322	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R324	24321/780	RESISTOR FIXED METAL-GLAZE 2K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2001-FT
R325	24772/055	RESISTOR FIXED METAL-FILM 180R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-180R-G-T-1
R326	24772/039	RESISTOR FIXED METAL-FILM 39R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-39R-G-T-1
R327	24773/253	RESISTOR FIXED METAL-FILM 150R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-150R
R328	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R329	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R330	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R331	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R332	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R333	24772/094	RESISTOR FIXED METAL-FILM 7K5 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-7K5-G-T-1
R334	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R335	24321/780	RESISTOR FIXED METAL-GLAZE 2K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2001-FT
R336	24772/055	RESISTOR FIXED METAL-FILM 180R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-180R-G-T-1
R337	24772/039	RESISTOR FIXED METAL-FILM 39R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-39R-G-T-1
R338	24773/253	RESISTOR FIXED METAL-FILM 150R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-150R
R339	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R340	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R341	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R342	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R343	24772/062	RESISTOR FIXED METAL-FILM 360R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-360R-G-T-1
R344	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R345	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
R346	24321/780	RESISTOR FIXED METAL-GLAZE 2K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2001-FT
R347	24321/727	RESISTOR FIXED METAL-GLAZE 12R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-12R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-12R1-FT
R348	24772/051	RESISTOR FIXED METAL-FILM 120R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-120R-G-T-1
R349	24772/025	RESISTOR FIXED METAL-FILM 10R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10R-G-T-1
R350	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R351	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R352	24772/074	RESISTOR FIXED METAL-FILM 1K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K1-G-T-1
R353	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R354	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R355	24321/766	RESISTOR FIXED METAL-GLAZE 510R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-511R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5110-FT
R356	24321/766	RESISTOR FIXED METAL-GLAZE 510R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-511R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5110-FT
R357	24772/066	RESISTOR FIXED METAL-FILM 510R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-510R-G-T-1
R358	24772/066	RESISTOR FIXED METAL-FILM 510R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-510R-G-T-1
R359	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R360	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R361	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R362	24321/725	RESISTOR FIXED METAL-GLAZE 10R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10R0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-10R0-FT
R363	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R364	24772/116	RESISTOR FIXED METAL-FILM 62K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-62K-G-T-1
R401	24772/035	RESISTOR FIXED METAL-FILM 27R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-27R-G-T-1
R402	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R403	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R404	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R405	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R406	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R407	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
R410	24321/731	RESISTOR FIXED METAL-GLAZE 18R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-18R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-18R2-FT
R413	24772/099	RESISTOR FIXED METAL-FILM 12K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-12K-G-T-1
R420	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R421	24321/725	RESISTOR FIXED METAL-GLAZE 10R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10R0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-10R0-FT
R422	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R423	24321/725	RESISTOR FIXED METAL-GLAZE 10R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10R0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-10R0-FT
R424	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R425	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R426	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
RLA	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLB	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLC	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLD	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
RLE	23486/166	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 12V COIL, 720R - CONTACTS 1A, 125V, MAX LOAD 30W, PCB	SDS-RELAIS LTD	DF2-DC12V
TR1	28451/694	TRANSISTOR NPN BIPOLAR BFR91A.... 12V 6GHz 300mW 35mA 40hFE @ 30mA, SURFACE MOUNTED, SOT-37.	PHILIPS	BFR91A
TR2	28459/068	TRANSISTOR N-CHANNEL-ENHANCE MOSFET BST70A... 80V 1W 500mA 2R TO-92, (LOOSE).	PHILIPS	BST70A
TR3	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR4	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR5	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR6	28435/868	TRANSISTOR PNP BIPOLAR 2N2905A.... 60V 200MHz 600mW 600mA 100hFE @ 150mA, TO-39.	NAT. SEMICONDUCTOR	2N2905A
TR10	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR11	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR12	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB2/2 RF board (contd.)				
TR13	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
TR310	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR311	28487/807	TRANSISTOR NPN BIPOLAR 42085.... 12V 6GHz 500mW 80mA 30hFE @ 35mA, 20dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-42085
TR312	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR313	28487/807	TRANSISTOR NPN BIPOLAR 42085.... 12V 6GHz 500mW 80mA 30hFE @ 35mA, 20dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-42085
TR314	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR315	28452/210	TRANSISTOR NPN BIPOLAR LTE21009R.. 16V 4W 250mA GAIN 8.5dB @ 2.1GHz, SURFACE MOUNTED, CASE-FO-41B.	PHILIPS	LTE21009R
TR401	28459/068	TRANSISTOR N-CHANNEL-ENHANCE MOSFET BST70A... 80V 1W 500mA 2R TO-92, (LOOSE).	PHILIPS	BST70A

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AB3/1 BFO switch and RPP board

Issue 4

When ordering, prefix circuit reference with AB3/1.

	44829-532Z	Complete unit		
C1	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C2	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C3	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C4	26386/777	CAPACITOR FIXED CERAMIC 47nF +/-20% 63V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	PHILIPS	1206 2R 473 K9 BB
C5	26386/865	CAPACITOR FIXED CERAMIC 1.5nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 152 KAT 00 J
C6	26386/851	CAPACITOR FIXED CERAMIC 100pF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	SYFER TECHNOLOGY LTD	0805-J-050-0101-K-R
C7	26386/851	CAPACITOR FIXED CERAMIC 100pF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	SYFER TECHNOLOGY LTD	0805-J-050-0101-K-R
C8	26386/865	CAPACITOR FIXED CERAMIC 1.5nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 152 KAT 00 J
C9	26386/777	CAPACITOR FIXED CERAMIC 47nF +/-20% 63V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	PHILIPS	1206 2R 473 K9 BB
C10	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C11	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
D1	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
D2	28371/417	DIODE ZENER, BZX79-C5V6... 500mW 5.6V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V6
D3	28371/417	DIODE ZENER, BZX79-C5V6... 500mW 5.6V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V6
D4	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D5	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
L1	23642/555	INDUCTOR FIXED 10uH +/- 10% COATED-LACQUER, MINIATURE, 470mA 0R9 MAX, 45 Q @ 7.9 MHz, 45 MHz	SIGMA PRODUCTS LTD	10-10-0525-10
L2	23642/555	INDUCTOR FIXED 10uH +/- 10% COATED-LACQUER, MINIATURE, 470mA 0R9 MAX, 45 Q @ 7.9 MHz, 45 MHz	SIGMA PRODUCTS LTD	10-10-0525-10
L3	23642/500	INDUCTOR FIXED 0.22uH +/- 20% MOULDED-EPOXY, 710mA 0R1 MAX, 40 Q @ 25.2 MHz, 150 MHz SRF, SURFACE	BICC-CITEC LTD	3613-A-R22-M

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/1	**BFO switch and RPP board (contd.)**			
R1	24773/265	RESISTOR FIXED METAL-FILM 470R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-470R
R2	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-4K7
R3	24773/289	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-4K7
RLA	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
RLB	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
TR1	28434/827	TRANSISTOR PNP BIPOLAR MPS6534.... 40V 250MHz 625mW 600mA 90hFE @ 100mA, TO-92, (LOOSE).	ALLEGRO MICROSYSTEMS	MPS6534
	43137/318	RIBBON-LEAD 20 WAY, SOCKET 20 WAY, KEY POS 5, - PLBR to SKBL, AB2/2	MARCONI INSTRUMENTS LTD	

AB3/2 Frequency doubler board

Issue 4

When ordering, prefix circuit reference with AB3/2.

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
	44829/545	Complete unit		
C1	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C2	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C3	26386/838	CAPACITOR FIXED CERAMIC 1.5nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210J050-0152J-C-C09
C4	26386/838	CAPACITOR FIXED CERAMIC 1.5nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210J050-0152J-C-C09
C5	26386/777	CAPACITOR FIXED CERAMIC 47nF +/-20% 63V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	PHILIPS	1206 2R 473 K9 BB
C6	26386/777	CAPACITOR FIXED CERAMIC 47nF +/-20% 63V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	PHILIPS	1206 2R 473 K9 BB
C7	26458/065	CAPACITOR FIXED ALUMINIUM 4.7uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.7 x 7.9mm,	PHILIPS	2222-127-25478
C8	26458/065	CAPACITOR FIXED ALUMINIUM 4.7uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.7 x 7.9mm,	PHILIPS	2222-127-25478
C9	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C10	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C11	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C12	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C13	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C14	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C15	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C16	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C17	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C18	26386/823	CAPACITOR FIXED CERAMIC 82pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 820 JAT 00 J
C19	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C20	26386/809	CAPACITOR FIXED CERAMIC 5.6pF +/-0.5pF 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 5R6 DAT 00 J
C21	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C22	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C23	26458/065	CAPACITOR FIXED ALUMINIUM 4.7uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.7 x 7.9mm,	PHILIPS	2222-127-25478

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/2	**Frequency doubler board (contd.)**			
C24	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C25	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C26	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C27	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C28	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C29	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C30	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C31	26386/820	CAPACITOR FIXED CERAMIC 47pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 470 JAT 00 J
C32	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C33	26386/823	CAPACITOR FIXED CERAMIC 82pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 820 JAT 00 J
C34	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C35	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C36	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C37	26386/823	CAPACITOR FIXED CERAMIC 82pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 820 JAT 00 J
C38	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C39	26386/823	CAPACITOR FIXED CERAMIC 82pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 820 JAT 00 J
C40	26582/436	CAPACITOR FIXED POLYESTER 68nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0683 KDC
C41	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C44	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C45	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C46	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C47	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C48	26386/823	CAPACITOR FIXED CERAMIC 82pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 820 JAT 00 J
C49	26386/823	CAPACITOR FIXED CERAMIC 82pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 820 JAT 00 J
C50	26386/823	CAPACITOR FIXED CERAMIC 82pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 820 JAT 00 J
C51	26582/426	CAPACITOR FIXED POLYESTER 10nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0103 KDC

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/2 Frequency doubler board (contd.)				
D1	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D2	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D3	28371/417	DIODE ZENER, BZX79-C5V6... 500mW 5.6V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V6
D4	28371/417	DIODE ZENER, BZX79-C5V6... 500mW 5.6V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V6
D5	28349/024	DIODE MIXER/DETECTOR, SCHOTTKY, DME3040... QUAD, 0.5pF 0.4Vf @ 1mA, S-BAND, MEDIUM-DRIVE, RING CCT,	ALPHA INDUSTRIES INC	DME3040
D6	28349/022	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2812... DUAL, 20V 1A 0.41Vf @ 1mA, MARKED B2, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2812-L31
D7	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D8	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D9	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D10	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D11	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D12	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D13	28383/997	DIODE PIN, 5082-3379... 250mW 50V 0.4pF VHF/UHF SWITCHING, AXIAL, HP-OUTLINE-15, (TAPED).	HEWLETT-PACKARD	5082-3379
D14	28371/417	DIODE ZENER, BZX79-C5V6... 500mW 5.6V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V6
D16	28383/902	DIODE SMALL-SIGNAL, BAW56... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON ANODE, MARKING CODE A1, SURFACE	PHILIPS	BAW56 (A1)
D17	28349/022	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2812... DUAL, 20V 1A 0.41Vf @ 1mA, MARKED B2, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2812-L31
D19	28349/025	DIODE MIXER/DETECTOR, SCHOTTKY, 5082-2209... 125mW 4V MEDIUM BARRIER, STRIPLINE TYPE, SUBSTRATE	HEWLETT-PACKARD	5082-2209
D20	28371/417	DIODE ZENER, BZX79-C5V6... 500mW 5.6V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V6
IC1	28461/388	IC ANALOGUE OPERATIONAL AMP LM324D... QUAD, GENERAL PURPOSE, LINEAR, BIPOLAR, 14 PIN,	MOTOROLA INC.	LM324D
IC2	28461/388	IC ANALOGUE OPERATIONAL AMP LM324D... QUAD, GENERAL PURPOSE, LINEAR, BIPOLAR, 14 PIN,	MOTOROLA INC.	LM324D
IC3	28465/056	IC DIGITAL DECODER/DEMULTIPLEX 74HC139.. 2 INPUT, 4 BIT, DUAL, INVERTING, 1 BIT ADDRESS,	HARRIS SEMICONDUCTOR	CD74HC139M
IC4	28461/388	IC ANALOGUE OPERATIONAL AMP LM324D... QUAD, GENERAL PURPOSE, LINEAR, BIPOLAR, 14 PIN,	MOTOROLA INC.	LM324D
IC5	28461/412	IC ANALOGUE OPERATIONAL AMP TL072... DUAL, 18V 3.0MHz BANDWIDTH, INPUT VOLTAGE RANGE +/-15V TYP,	MOTOROLA INC.	TL072CD

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/2	**Frequency doubler board (contd.)**			
L1	23642/041	INDUCTOR FIXED 0.027uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.8A 0R0085 MAX, 33 Q @ 30 MHz, 1.2K	SIGMA PRODUCTS LTD	30-10-2562-10
L2	23642/041	INDUCTOR FIXED 0.027uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.8A 0R0085 MAX, 33 Q @ 30 MHz, 1.2K	SIGMA PRODUCTS LTD	30-10-2562-10
L3	23642/041	INDUCTOR FIXED 0.027uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.8A 0R0085 MAX, 33 Q @ 30 MHz, 1.2K	SIGMA PRODUCTS LTD	30-10-2562-10
L4	23642/041	INDUCTOR FIXED 0.027uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.8A 0R0085 MAX, 33 Q @ 30 MHz, 1.2K	SIGMA PRODUCTS LTD	30-10-2562-10
L5	23642/041	INDUCTOR FIXED 0.027uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.8A 0R0085 MAX, 33 Q @ 30 MHz, 1.2K	SIGMA PRODUCTS LTD	30-10-2562-10
L6	23642/041	INDUCTOR FIXED 0.027uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.8A 0R0085 MAX, 33 Q @ 30 MHz, 1.2K	SIGMA PRODUCTS LTD	30-10-2562-10
L7	23642/041	INDUCTOR FIXED 0.027uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.8A 0R0085 MAX, 33 Q @ 30 MHz, 1.2K	SIGMA PRODUCTS LTD	30-10-2562-10
L8	15110/2269	WIRE COPPER TINNED 0.45 mm, 26 SWG, NON-INSULATED, TO BS.4109, ON 0.5KG REELS	MARCONI INSTRUMENTS LTD	
L10	23642/423	INDUCTOR FIXED 10uH +/- 10% MOULDED-EPOXY, MINIATURE, 180mA 3R7 MAX, 55 Q @ 7.9 MHz, 46 MHz	SIGMA PRODUCTS LTD	30-10-2525-10
L11	23642/423	INDUCTOR FIXED 10uH +/- 10% MOULDED-EPOXY, MINIATURE, 180mA 3R7 MAX, 55 Q @ 7.9 MHz, 46 MHz	SIGMA PRODUCTS LTD	30-10-2525-10
L12	23642/418	INDUCTOR FIXED 0.1uH +/- 10% MOULDED-EPOXY, MINIATURE, 1.24A 0R08 MAX, 35 Q @ 25 MHz, 625 MHz	DELEVAN (US)	1025-94
L13	23642/418	INDUCTOR FIXED 0.1uH +/- 10% MOULDED-EPOXY, MINIATURE, 1.24A 0R08 MAX, 35 Q @ 25 MHz, 625 MHz	DELEVAN (US)	1025-94
L14	23642/500	INDUCTOR FIXED 0.22uH +/- 20% MOULDED-EPOXY, 710mA 0R1 MAX, 40 Q @ 25.2 MHz, 150 MHz SRF, SURFACE	BICC-CITEC LTD	3613-A-R22-M
L15	15110/2269	WIRE COPPER TINNED 0.45 mm, 26 SWG, NON-INSULATED, TO BS.4109, ON 0.5KG REELS	MARCONI INSTRUMENTS LTD	
L16	44190/099	CHOKE ASSY (FOR AB3/2 BOARD)	MARCONI INSTRUMENTS LTD	
L17	15110/2269	WIRE COPPER TINNED 0.45 mm, 26 SWG, NON-INSULATED, TO BS.4109, ON 0.5KG REELS	MARCONI INSTRUMENTS LTD	
R1	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R2	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R3	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R4	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R5	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R6	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R7	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R8	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/2 Frequency doubler board (contd.)				
R9	24772/055	RESISTOR FIXED METAL-FILM 180R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-180R-G-T-1
R10	24321/805	RESISTOR FIXED METAL-GLAZE 22K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-22K1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2212-FT
R12	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R13	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R14	24321/731	RESISTOR FIXED METAL-GLAZE 18R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-18R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-18R2-FT
R15	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R16	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R17	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R18	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R19	24321/815	RESISTOR FIXED METAL-GLAZE 56K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-56K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5622-FT
R20	24321/738	RESISTOR FIXED METAL-GLAZE 36R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-36R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-36R5-FT
R21	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R22	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R23	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R24	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R25	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R26	24321/754	RESISTOR FIXED METAL-GLAZE 160R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-162R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1620-FT
R27	24331/961	RESISTOR FIXED CARBON-COMPOSITION 180R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1815
R28	24321/805	RESISTOR FIXED METAL-GLAZE 22K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-22K1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2212-FT
R29	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R30	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R32	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R33	24331/976	RESISTOR FIXED CARBON-COMPOSITION 220R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB2215
R34	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R35	24321/796	RESISTOR FIXED METAL-GLAZE 9K1 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-9K09-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-9091-FT
R36	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/2	**Frequency doubler board (contd.)**			
R37	24321/809	RESISTOR FIXED METAL-GLAZE 33K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3322-FT
R38	24321/837	RESISTOR FIXED METAL-GLAZE 470K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4753-FT
R39	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R40	24321/745	RESISTOR FIXED METAL-GLAZE 68R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-68R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-68R1-FT
R41	24681/528	RESISTOR NETWORK ISOLATED, THICK-FILM, 10K 2% 480mW 50V 200 ppm/DEG.C, 8 RESISTORS, SURFACE	BOURNS ELECTRONICS	4816P-001-103
R42	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R43	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R44	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R45	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R46	24681/526	RESISTOR NETWORK ISOLATED, THICK-FILM, 100R 2% 500mW 25V 200 ppm/DEG.C, 7 RESISTORS, SURFACE	BOURNS ELECTRONICS	4814P-001-101
R47	24321/734	RESISTOR FIXED METAL-GLAZE 24R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-24R3-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-24R3-FT
R48	24321/735	RESISTOR FIXED METAL-GLAZE 27R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-27R4-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-27R4-FT
R49	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R50	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R51	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R52	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R53	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R54	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R55	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R56	24321/750	RESISTOR FIXED METAL-GLAZE 110R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-110R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1100-FT
R57	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R58	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R59	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R60	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R63	24331/961	RESISTOR FIXED CARBON-COMPOSITION 180R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1815
R64	24773/257	RESISTOR FIXED METAL-FILM 220R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-220R

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/2 Frequency doubler board (contd.)				
R66	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R67	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R68	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R69	24321/735	RESISTOR FIXED METAL-GLAZE 27R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-27R4-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-27R4-FT
R70	24321/752	RESISTOR FIXED METAL-GLAZE 130R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-130R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1300-FT
R71	24321/735	RESISTOR FIXED METAL-GLAZE 27R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-27R4-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-27R4-FT
R70	24321/752	RESISTOR FIXED METAL-GLAZE 130R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-130R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1300-FT
R72	24772/060	RESISTOR FIXED METAL-FILM 300R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	DALE ELECTROSIL LTD	CMF51-300R-G-T-1
R76	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R77	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R77	24331/964	RESISTOR FIXED CARBON-COMPOSITION 470R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB4715
R78	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
RLA	23486/146	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 100R - CONTACTS 1A @ 28VDC, 200mA @ 115VAC,	TELEDYNE LTD	J134-5PL
RLB	23486/146	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 100R - CONTACTS 1A @ 28VDC, 200mA @ 115VAC,	TELEDYNE LTD	J134-5PL
RLC	23486/146	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 100R - CONTACTS 1A @ 28VDC, 200mA @ 115VAC,	TELEDYNE LTD	J134-5PL
RLD	23486/146	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 100R - CONTACTS 1A @ 28VDC, 200mA @ 115VAC,	TELEDYNE LTD	J134-5PL
TR1	28487/813	TRANSISTOR NPN BIPOLAR 41435.... 12V 6GHz 500mW 60mA LOW NOISE, SURFACE MOUNTED, CASE-AVANTEK-X.	AVANTEK (US) INC	AT-41435
TR2	28487/807	TRANSISTOR NPN BIPOLAR 42085.... 12V 6GHz 500mW 80mA 30hFE @ 35mA, 20dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-42085
TR3	28487/808	TRANSISTOR NPN BIPOLAR 64023... 20V 4GHz 3W 200mA 20hFE @ 110mA, 27dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-64023
TR4	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR5	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR6	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR7	28487/807	TRANSISTOR NPN BIPOLAR 42085.... 12V 6GHz 500mW 80mA 30hFE @ 35mA, 20dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-42085

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/2 Frequency doubler board (contd.)				
TR8	28455/421	TRANSISTOR NPN BIPOLAR BC237A.... 45V 150MHz 200mW 100mA 170hFE @ 2mA, TO-92, (LOOSE).	NAT. SEMICONDUCTOR	BC237A
	43137/318	RIBBON-LEAD 20 WAY, SOCKET 20 WAY, KEY POS 5, - PCB TRANSITION 20 WAY, FLAT MULTICOLOUR CABLE, PLBR to SKBL, AB2/2	MARCONI INSTRUMENTS LTD	

AB3/3 High power amplifier board

Issue 6

When ordering, prefix circuit reference with AB3/3.

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
	44829/547	Complete unit		
C1	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C2	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C3	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C4	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C5	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C6	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C7	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C8	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C9	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C10	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C11	26386/865	CAPACITOR FIXED CERAMIC 1.5nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 152 KAT 00 J
C12	26386/865	CAPACITOR FIXED CERAMIC 1.5nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 152 KAT 00 J
C13	26386/777	CAPACITOR FIXED CERAMIC 47nF +/-20% 63V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	PHILIPS	1206 2R 473 K9 BB
C14	26386/777	CAPACITOR FIXED CERAMIC 47nF +/-20% 63V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	PHILIPS	1206 2R 473 K9 BB
C15	26458/065	CAPACITOR FIXED ALUMINIUM 4.7uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.7 x 7.9mm,	PHILIPS	2222-127-25478
C16	26458/065	CAPACITOR FIXED ALUMINIUM 4.7uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.7 x 7.9mm,	PHILIPS	2222-127-25478
C17	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C18	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C19	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C20	26458/065	CAPACITOR FIXED ALUMINIUM 4.7uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.7 x 7.9mm,	PHILIPS	2222-127-25478
C21	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C22	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C23	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/3	**High power amplifier board (contd.)**			
C24	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C25	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C26	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C27	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C28	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C31	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C34	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C35	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C36	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C37	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C38	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C39	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C40	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C41	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C42	26386/754	CAPACITOR FIXED CERAMIC 10nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 103 K9 BB
C43	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
D1	28371/735	DIODE ZENER, BZX84-C8V2... 350mW 8.2V 5% 250mA MARKING CODE Z7, SURFACE MOUNTED, SOT-23, (TAPED).	PHILIPS	BZX84-C8V2
D2	28371/735	DIODE ZENER, BZX84-C8V2... 350mW 8.2V 5% 250mA MARKING CODE Z7, SURFACE MOUNTED, SOT-23, (TAPED).	PHILIPS	BZX84-C8V2
D3	28383/902	DIODE SMALL-SIGNAL, BAW56... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON ANODE, MARKING CODE A1, SURFACE	PHILIPS	BAW56 (A1)
D4	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D5	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D6	28383/916	DIODE PIN, BAR61... TRIPLE, 100V 1A 0.25pF 1Vf @ 100mA, PI-CIRCUIT, MARKING CODE 61, SURFACE	SIEMENS LTD	BAR61
D7	28383/902	DIODE SMALL-SIGNAL, BAW56... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON ANODE, MARKING CODE A1, SURFACE	PHILIPS	BAW56 (A1)
D8	28349/029	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2810... 250mW 20V 1.2pF 1Vf @ 35mA, MARKED B0, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2810-L31

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/3 High power amplifier board (contd.)				
D9	28349/029	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2810... 250mW 20V 1.2pF 1Vf @ 35mA, MARKED B0, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2810-L31
D10	28349/029	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2810... 250mW 20V 1.2pF 1Vf @ 35mA, MARKED B0, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2810-L31
IC1	28461/413	IC ANALOGUE OPERATIONAL AMP TL074... QUAD, JFET INPUT, LOW NOISE, 14 PIN, SMALL-OUTLINE.	MOTOROLA INC.	TL074CD
IC2	28461/413	IC ANALOGUE OPERATIONAL AMP TL074... QUAD, JFET INPUT, LOW NOISE, 14 PIN, SMALL-OUTLINE.	MOTOROLA INC.	TL074CD
L1	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L2	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L3	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L4	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L5	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L6	23642/419	INDUCTOR FIXED 1uH +/- 10% MOULDED-EPOXY, MINIATURE, 350mA 1R MAX, 25 Q @ 25 MHz, 210 MHz	DELEVAN (US)	1025-20
L7	23642/500	INDUCTOR FIXED 0.22uH +/- 20% MOULDED-EPOXY, 710mA 0R1 MAX, 40 Q @ 25.2 MHz, 150 MHz SRF, SURFACE	BICC-CITEC LTD	3613-A-R22-M
R1	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R2	24321/775	RESISTOR FIXED METAL-GLAZE 1K2 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K21-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1211-FT
R3	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R4	24321/760	RESISTOR FIXED METAL-GLAZE 300R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-301R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3010-FT
R5	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R6	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R7	24321/779	RESISTOR FIXED METAL-GLAZE 1K8 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K82-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1821-FT
R8	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R9	24321/791	RESISTOR FIXED METAL-GLAZE 5K6 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-5K62-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5621-FT
R10	24321/781	RESISTOR FIXED METAL-GLAZE 2K2 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K21-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2211-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/3	**High power amplifier board (contd.)**			
R11	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R12	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R13	24321/793	RESISTOR FIXED METAL-GLAZE 6K8 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-6K81-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-6811-FT
R14	24321/794	RESISTOR FIXED METAL-GLAZE 7K5 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-7K50-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-7501-FT
R15	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R16	24331/998	RESISTOR FIXED CARBON-COMPOSITION 120R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1215
R17	24573/053	RESISTOR FIXED METAL-OXIDE 150R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-150R-2%
R18	24573/053	RESISTOR FIXED METAL-OXIDE 150R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-150R-2%
R19	24321/736	RESISTOR FIXED METAL-GLAZE 30R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-30R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-30R1-FT
R20	24321/736	RESISTOR FIXED METAL-GLAZE 30R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-30R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-30R1-FT
R21	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R22	24321/800	RESISTOR FIXED METAL-GLAZE 13K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-13K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1302-FT
R23	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R24	24331/997	RESISTOR FIXED CARBON-COMPOSITION 100R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1015
R25	24321/758	RESISTOR FIXED METAL-GLAZE 240R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-243R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2430-FT
R26	24552/014	RESISTOR FIXED METAL-OXIDE 5R6 +/- 5% 500mW 350V 250 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	WELWYN ELECTRONICS	MFR5-5R6-5%
R27	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R28	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R29	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R30	24321/837	RESISTOR FIXED METAL-GLAZE 470K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4753-FT
R31	24321/837	RESISTOR FIXED METAL-GLAZE 470K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4753-FT
R32	24321/816	RESISTOR FIXED METAL-GLAZE 62K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-61K9-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-6192-FT
R33	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R34	24321/816	RESISTOR FIXED METAL-GLAZE 62K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-61K9-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-6192-FT
R35	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R36	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/3 High power amplifier board (contd.)				
R37	24321/790	RESISTOR FIXED METAL-GLAZE 5K1 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-5K11-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5111-FT
R38	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R39	24321/790	RESISTOR FIXED METAL-GLAZE 5K1 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-5K11-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5111-FT
R40	24321/837	RESISTOR FIXED METAL-GLAZE 470K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4753-FT
R41	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R42	24321/814	RESISTOR FIXED METAL-GLAZE 51K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51K1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5112-FT
R43	24321/804	RESISTOR FIXED METAL-GLAZE 20K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-20K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2002-FT
R44	24321/804	RESISTOR FIXED METAL-GLAZE 20K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-20K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2002-FT
R45	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R46	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R47	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R48	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R49	24321/821	RESISTOR FIXED METAL-GLAZE 100K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1003-FT
R50	24321/804	RESISTOR FIXED METAL-GLAZE 20K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-20K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2002-FT
R51	24321/821	RESISTOR FIXED METAL-GLAZE 100K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1003-FT
R52	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R53	24321/804	RESISTOR FIXED METAL-GLAZE 20K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-20K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2002-FT
R54	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R55	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R56	24321/816	RESISTOR FIXED METAL-GLAZE 62K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-61K9-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-6192-FT
R57	24321/756	RESISTOR FIXED METAL-GLAZE 200R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-200R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2000-FT
R58	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
RLB	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
RLC	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/3	**High power amplifier board (contd.)**			
TR1	28435/241	TRANSISTOR PNP BIPOLAR BCX17... 45V 100MHz 425mW 500mA MARKING CODE T1, SURFACE MOUNTED, SOT-23,	MOTOROLA INC.	BCX17
TR3	28453/829	TRANSISTOR NPN BIPOLAR BC848B.... 30V 200MHz 200mW 100mA 520hFE @ 2mA, MARKING CODE 1K, SURFACE	PHILIPS	BC848B
TR4	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR5	28487/823	TRANSISTOR NPN BIPOLAR AT-64020.. 20V 4.0GHz 200mA GAIN 10dB @ 2GHz, 28dBm O/P POWR, SURFACE MOUNTED,	AVANTEK (US) INC	AT-64020
TR6	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR7	28487/821	TRANSISTOR NPN BIPOLAR LTE21015R.. 20V 2.1GHz 1.6W 450mA GAIN 8dB @ 2.1GHz, SURFACE MOUNTED,	PHILIPS	LTE21015R
	43137/318	RIBBON -LEAD 20 WAY, SOCKET 20 WAY, KEY POS 5, - PLBR to SKBL, AB2/2	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AB3/4 Quadrupler board

Issue 11

When ordering, prefix circuit reference with AB3/4. This board must only be transported when enclosed within Packing Box 37136-647F.

	44829/646	Complete unit		
C1	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C2	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C3	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C4	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C5	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C6	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C7	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C8	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C9	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C10	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C11	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C12	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C13	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C14	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C15	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C16	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C17	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C18	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C19	26373/733	CAPACITOR FIXED CERAMIC 1nF -20/+80% 300V K3000 FEED-THROUGH, SOLDER-IN MOUNTING, 3.9mm MOUNTING	MIDLAND CAPACITORS	FT73/29-K3000-1000pF
C101	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C102	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C103	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C104	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4 Quadrupler board (contd.)				
C105	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C106	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C107	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C108	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C109	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C110	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C111	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C112	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C113	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C114	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C115	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C116	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C117	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C118	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C119	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C120	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C121	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C122	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C123	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C124	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C125	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C126	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C127	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C128	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C129	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C130	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4 Quadrupler board (contd.)				
C131	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C132	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C201	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C202	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C203	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C204	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C205	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C206	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C207	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C208	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C209	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C210	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C211	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C212	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C213	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C214	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C216	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C217	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C218	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C219	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C220	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C221	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C222	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C223	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C224	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C225	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4 Quadrupler board (contd.)				
C226	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C227	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C228	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C229	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C230	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C231	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C232	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C233	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C234	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C235	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C236	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C237	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C238	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C239	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C240	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C241	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C242	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C301	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C302	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C303	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C304	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C305	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C306	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C307	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C308	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C309	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J

AB3/4 Quadrupler board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
C310	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C311	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C312	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C313	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C314	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C315	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C316	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C317	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C318	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C401	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C402	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C403	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C404	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C405	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C406	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C407	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C408	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C409	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C410	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C411	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C412	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C413	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C414	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C415	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C416	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C417	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4 Quadrupler board (contd.)				
C418	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C419	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C420	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C421	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C422	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C423	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C424	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C425	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C426	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C427	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C428	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C429	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C430	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C431	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C432	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C433	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C435	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C436	26386/830	CAPACITOR FIXED CERAMIC 330pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 331 JAT 00 J
C437	26386/816	CAPACITOR FIXED CERAMIC 22pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 220 JAT 00 J
C438	26386/951	CAPACITOR FIXED CERAMIC 47nF -20/+80% 50V Z5U/2F4 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5E 473 ZAT 00 J
D101	28383/902	DIODE SMALL-SIGNAL, BAW56... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON ANODE, MARKING CODE A1, SURFACE	PHILIPS	BAW56 (A1)
D102	28349/022	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2812... DUAL, 20V 1A 0.41Vf @ 1mA, MARKED B2, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2812-L31
D103	28349/024	DIODE MIXER/DETECTOR, SCHOTTKY, DME3040... QUAD, 0.5pF 0.4Vf @ 1mA, S-BAND, MEDIUM-DRIVE, RING CCT,	ALPHA INDUSTRIES INC	DME3040
D104	28383/902	DIODE SMALL-SIGNAL, BAW56... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON ANODE, MARKING CODE A1, SURFACE	PHILIPS	BAW56 (A1)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4 Quadrupler board (contd.)				
D105	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D106	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D107	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D108	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D109	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D201	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D202	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D203	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D204	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D205	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D206	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D207	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D208	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D209	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D210	28349/022	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2812... DUAL, 20V 1A 0.41Vf @ 1mA, MARKED B2, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2812-L31
D211	28349/024	DIODE MIXER/DETECTOR, SCHOTTKY, DME3040... QUAD, 0.5pF 0.4Vf @ 1mA, S-BAND, MEDIUM-DRIVE, RING CCT,	ALPHA INDUSTRIES INC	DME3040
D212	28372/471	DIODE ZENER, BZX84-C15... 350mW 15V 5% 250mA MARKING CODE Y4, SURFACE MOUNTED, SOT-23, (TAPED).	PHILIPS	BZX84-C15
D213	28371/216	DIODE ZENER, BZX84-C3V3... 350mW 3.3V 5% 250mA MARKING CODE Z14/W6, SURFACE MOUNTED, SOT-23,	PHILIPS	BZX84-C3V3
D214	28371/216	DIODE ZENER, BZX84-C3V3... 350mW 3.3V 5% 250mA MARKING CODE Z14/W6, SURFACE MOUNTED, SOT-23,	PHILIPS	BZX84-C3V3
D301	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D302	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D303	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D304	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D305	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D306	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D307	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4	**Quadrupler board (contd.)**			
D308	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D309	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D401	28372/471	DIODE ZENER, BZX84-C15... 350mW 15V 5% 250mA MARKING CODE Y4, SURFACE MOUNTED, SOT-23, (TAPED).	PHILIPS	BZX84-C15
D402	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D403	28383/902	DIODE SMALL-SIGNAL, BAW56... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON ANODE, MARKING CODE A1, SURFACE	PHILIPS	BAW56 (A1)
D404	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D405	28383/917	DIODE PIN, CSB7003-01... 200V 100mA 0.05pF @ -50V, SUBSTRATE MOUNTED, 1.35mm DIA, CASE-96, (BOXED).	ALPHA INDUSTRIES INC	CSB7003-01-320-001
D406	28383/917	DIODE PIN, CSB7003-01... 200V 100mA 0.05pF @ -50V, SUBSTRATE MOUNTED, 1.35mm DIA, CASE-96, (BOXED).	ALPHA INDUSTRIES INC	CSB7003-01-320-001
D407	28349/025	DIODE MIXER/DETECTOR, SCHOTTKY, 5082-2209... 125mW 4V MEDIUM BARRIER, STRIPLINE TYPE, SUBSTRATE	HEWLETT-PACKARD	5082-2209
D408	28349/022	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2812... DUAL, 20V 1A 0.41Vf @ 1mA, MARKED B2, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2812-L31
D409	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D410	28371/216	DIODE ZENER, BZX84-C3V3... 350mW 3.3V 5% 250mA MARKING CODE Z14/W6, SURFACE MOUNTED, SOT-23,	PHILIPS	BZX84-C3V3
IC101	28465/056	IC DIGITAL DECODER/DEMULTIPLEX 74HC139.. 2 INPUT, 4 BIT, DUAL, INVERTING, 1 BIT ADDRESS,	HARRIS SEMICONDUCTOR	CD74HC139M
IC102	28461/413	IC ANALOGUE OPERATIONAL AMP TL074... QUAD, JFET INPUT, LOW NOISE, 14 PIN, SMALL-OUTLINE.	MOTOROLA INC.	TL074CD
IC201	28461/413	IC ANALOGUE OPERATIONAL AMP TL074... QUAD, JFET INPUT, LOW NOISE, 14 PIN, SMALL-OUTLINE.	MOTOROLA INC.	TL074CD
IC401	28461/676	IC ANALOGUE COMPARATOR 311.. 2 INPUT, SINGLE, 15V 500mW, LINEAR, MONOLITHIC, 8 PIN, SMALL-OUTLINE.	TEXAS INSTRUMENTS	LM311D
IC402	28461/412	IC ANALOGUE OPERATIONAL AMP TL072... DUAL, 18V 3.0MHz BANDWIDTH, INPUT VOLTAGE RANGE +/-15V TYP,	MOTOROLA INC.	TL072CD
L101	23642/500	INDUCTOR FIXED 0.22uH +/- 20% MOULDED-EPOXY, 710mA 0R1 MAX, 40 Q @ 25.2 MHz, 150 MHz SRF, SURFACE	BICC-CITEC LTD	3613-A-R22-M
L102	23642/500	INDUCTOR FIXED 0.22uH +/- 20% MOULDED-EPOXY, 710mA 0R1 MAX, 40 Q @ 25.2 MHz, 150 MHz SRF, SURFACE	BICC-CITEC LTD	3613-A-R22-M
L103	23642/500	INDUCTOR FIXED 0.22uH +/- 20% MOULDED-EPOXY, 710mA 0R1 MAX, 40 Q @ 25.2 MHz, 150 MHz SRF, SURFACE	BICC-CITEC LTD	3613-A-R22-M
L401	23642/500	INDUCTOR FIXED 0.22uH +/- 20% MOULDED-EPOXY, 710mA 0R1 MAX, 40 Q @ 25.2 MHz, 150 MHz SRF, SURFACE	BICC-CITEC LTD	3613-A-R22-M
L402	23642/418	INDUCTOR FIXED 0.1uH +/- 10% MOULDED-EPOXY, MINIATURE, 1.24A 0R08 MAX, 35 Q @ 25 MHz, 625 MHz	DELEVAN (US)	1025-94

AB3/4 Quadrupler board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R101	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R102	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R103	24321/769	RESISTOR FIXED METAL-GLAZE 680R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-681R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-6810-FT
R104	24321/815	RESISTOR FIXED METAL-GLAZE 56K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-56K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5622-FT
R105	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R106	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R107	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R108	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R109	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R110	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R111	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R112	24321/815	RESISTOR FIXED METAL-GLAZE 56K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-56K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5622-FT
R113	24321/738	RESISTOR FIXED METAL-GLAZE 36R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-36R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-36R5-FT
R114	24772/053	RESISTOR FIXED METAL-FILM 150R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-150R-G-T-1
R115	24321/731	RESISTOR FIXED METAL-GLAZE 18R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-18R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-18R2-FT
R116	24321/725	RESISTOR FIXED METAL-GLAZE 10R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10R0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-10R0-FT
R117	24321/760	RESISTOR FIXED METAL-GLAZE 300R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-301R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3010-FT
R118	24331/961	RESISTOR FIXED CARBON-COMPOSITION 180R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1815
R119	24321/745	RESISTOR FIXED METAL-GLAZE 68R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-68R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-68R1-FT
R120	24321/745	RESISTOR FIXED METAL-GLAZE 68R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-68R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-68R1-FT
R121	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R122	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R123	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R124	24321/801	RESISTOR FIXED METAL-GLAZE 15K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-15K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1502-FT
R125	24321/780	RESISTOR FIXED METAL-GLAZE 2K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2001-FT
R126	24321/803	RESISTOR FIXED METAL-GLAZE 18K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-18K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1822-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4	**Quadrupler board (contd.)**			
R127	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R128	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R129	24321/777	RESISTOR FIXED METAL-GLAZE 1K5 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K50-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1501-FT
R130	24321/725	RESISTOR FIXED METAL-GLAZE 10R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10R0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-10R0-FT
R131	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R132	24321/777	RESISTOR FIXED METAL-GLAZE 1K5 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K50-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1501-FT
R133	24321/767	RESISTOR FIXED METAL-GLAZE 560R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-562R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5620-FT
R134	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R135	24321/811	RESISTOR FIXED METAL-GLAZE 39K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-39K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3922-FT
R136	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R137	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R138	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R139	24321/777	RESISTOR FIXED METAL-GLAZE 1K5 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K50-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1501-FT
R140	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R141	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R142	24331/961	RESISTOR FIXED CARBON-COMPOSITION 180R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1815
R143	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R144	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R145	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R146	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R147	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R148	24321/803	RESISTOR FIXED METAL-GLAZE 18K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-18K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1822-FT
R149	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R150	24321/790	RESISTOR FIXED METAL-GLAZE 5K1 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-5K11-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5111-FT
R151	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R152	24681/085	RESISTOR FIXED METAL-GLAZE 68R +/- 5% 1W 100V 300 ppm/DEG.C, SURFACE MOUNTED, SIZE 2512, (LOOSE).	VTM (UK) LTD	509-0-680-5%-300PPM

AB3/4 Quadrupler board (contd.)

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R153	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R154	24331/998	RESISTOR FIXED CARBON-COMPOSITION 120R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1215
R155	24321/725	RESISTOR FIXED METAL-GLAZE 10R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10R0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-10R0-FT
R156	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R157	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R158	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R159	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R160	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R161	24321/760	RESISTOR FIXED METAL-GLAZE 300R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-301R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3010-FT
R162	24321/765	RESISTOR FIXED METAL-GLAZE 470R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4750-FT
R201	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R202	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R203	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R204	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R205	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R206	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R207	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R208	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R209	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R210	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R211	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R212	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R213	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R214	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R215	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R216	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT

AB3/4 Quadrupler board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R217	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R218	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R219	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R220	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R221	24331/961	RESISTOR FIXED CARBON-COMPOSITION 180R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1815
R222	24681/085	RESISTOR FIXED METAL-GLAZE 68R +/- 5% 1W 100V 300 ppm/DEG.C, SURFACE MOUNTED, SIZE 2512, (LOOSE).	VTM (UK) LTD	509-0-680-5%-300PPM
R223	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R224	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R225	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R226	24321/815	RESISTOR FIXED METAL-GLAZE 56K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-56K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5622-FT
R227	24321/738	RESISTOR FIXED METAL-GLAZE 36R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-36R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-36R5-FT
R228	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT
R229	24321/731	RESISTOR FIXED METAL-GLAZE 18R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-18R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-18R2-FT
R230	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R231	24321/761	RESISTOR FIXED METAL-GLAZE 330R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-332R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3320-FT
R232	24321/725	RESISTOR FIXED METAL-GLAZE 10R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10R0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-10R0-FT
R233	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R234	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R235	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R236	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R237	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R238	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R239	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R240	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R241	24321/805	RESISTOR FIXED METAL-GLAZE 22K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-22K1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2212-FT
R242	24321/790	RESISTOR FIXED METAL-GLAZE 5K1 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-5K11-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5111-FT

AB3/4 Quadrupler board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R243	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R244	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R245	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R246	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R247	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R248	24321/813	RESISTOR FIXED METAL-GLAZE 47K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47K5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4752-FT
R249	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R250	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R251	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R252	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R253	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R254	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R255	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R256	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R257	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R258	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R259	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R260	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R261	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R262	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R263	24321/813	RESISTOR FIXED METAL-GLAZE 47K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47K5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4752-FT
R264	24321/789	RESISTOR FIXED METAL-GLAZE 4K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-4K75-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4751-FT
R265	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R301	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R302	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R303	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT

AB3/4 Quadrupler board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R304	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R305	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R306	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R307	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R308	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R309	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R310	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R311	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R312	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R313	24321/760	RESISTOR FIXED METAL-GLAZE 300R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-301R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3010-FT
R314	24321/730	RESISTOR FIXED METAL-GLAZE 16R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-16R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-16R2-FT
R315	24321/760	RESISTOR FIXED METAL-GLAZE 300R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-301R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3010-FT
R316	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R317	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R318	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R319	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R401	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT
R402	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R403	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R404	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT
R405	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R406	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R407	24321/730	RESISTOR FIXED METAL-GLAZE 16R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-16R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-16R2-FT
R408	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R409	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R410	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4 Quadrupler board (contd.)				
R412	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R413	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R415	24321/763	RESISTOR FIXED METAL-GLAZE 390R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-392R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3920-FT
R416	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R417	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R418	24321/787	RESISTOR FIXED METAL-GLAZE 3K9 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-3K92-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3921-FT
R419	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R420	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R421	24321/755	RESISTOR FIXED METAL-GLAZE 180R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-182R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1820-FT
R422	24681/086	RESISTOR FIXED METAL-GLAZE 8R2 +/- 5% 1W 100V 300 ppm/DEG.C, SURFACE MOUNTED, SIZE 2512, (LOOSE).	DALE ELECTROSIL LTD	CRCW-2512-8R2-J-B02
R423	24321/745	RESISTOR FIXED METAL-GLAZE 68R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-68R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-68R1-FT
R424	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R425	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R426	24321/757	RESISTOR FIXED METAL-GLAZE 220R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-221R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2210-FT
R427	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R428	24321/787	RESISTOR FIXED METAL-GLAZE 3K9 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-3K92-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3921-FT
R429	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R430	24321/790	RESISTOR FIXED METAL-GLAZE 5K1 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-5K11-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5111-FT
R431	24321/755	RESISTOR FIXED METAL-GLAZE 180R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-182R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1820-FT
R432	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R433	24681/087	RESISTOR FIXED METAL-GLAZE 5R6 +/- 5% 1W 100V 300 ppm/DEG.C, SURFACE MOUNTED, SIZE 2512, (LOOSE).	DALE ELECTROSIL LTD	CRCW-2512-5R6-J-B02
R434	24321/781	RESISTOR FIXED METAL-GLAZE 2K2 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K21-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2211-FT
R435	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R436	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R437	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R438	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4 Quadrupler board (contd.)				
R439	24321/751	RESISTOR FIXED METAL-GLAZE 120R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1210-FT
R440	24321/781	RESISTOR FIXED METAL-GLAZE 2K2 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K21-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2211-FT
R441	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R442	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R443	24321/833	RESISTOR FIXED METAL-GLAZE 330K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-332K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3323-FT
R444	24321/741	RESISTOR FIXED METAL-GLAZE 47R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-47R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-47R5-FT
R445	24321/809	RESISTOR FIXED METAL-GLAZE 33K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3322-FT
R446	24321/608	RESISTOR FIXED METAL-GLAZE 10M +/- 10% 125mW 200V 500 ppm/DEG.C, SURFACE MOUNTED, SIZE 1206, (LOOSE	PANASONIC INDUSTRIAL	ERJ-8GEK106V
R447	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT
R448	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R449	24321/809	RESISTOR FIXED METAL-GLAZE 33K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3322-FT
R450	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R451	24321/760	RESISTOR FIXED METAL-GLAZE 300R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-301R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3010-FT
R452	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R453	24321/815	RESISTOR FIXED METAL-GLAZE 56K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-56K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5622-FT
RLA	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
RLB	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
RLC	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
RLD	23486/156	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 100R - CONTACTS 1A @ 28VDC, 200mA @ 115VAC, PCB	TELEDYNE LTD	732-5
T101	43590/209	WOUND-PART TRANSFORMER, RING-CORE, 12:12 TURNS, TWISTED BIFILAR WOUND, UNMOUNTED.	AMETHYST DESIGNS LTD	AD5118
T201	43590/228	WOUND-PART TRANSFORMER, RING-CORE, 7:7 TURNS, TWISTED BIFILAR WOUND, UNMOUNTED.	AMETHYST DESIGNS LTD	AD5282

AB3/4 Quadrupler board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
TR101	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR102	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR103	28435/241	TRANSISTOR PNP BIPOLAR BCX17... 45V 100MHz 425mW 500mA MARKING CODE T1, SURFACE MOUNTED, SOT-23,	MOTOROLA INC.	BCX17
TR104	28435/241	TRANSISTOR PNP BIPOLAR BCX17... 45V 100MHz 425mW 500mA MARKING CODE T1, SURFACE MOUNTED, SOT-23,	MOTOROLA INC.	BCX17
TR105	28487/807	TRANSISTOR NPN BIPOLAR 42085.... 12V 6GHz 500mW 80mA 30hFE @ 35mA, 20dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-42085
TR106	28487/807	TRANSISTOR NPN BIPOLAR 42085.... 12V 6GHz 500mW 80mA 30hFE @ 35mA, 20dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-42085
TR107	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR108	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR109	28435/241	TRANSISTOR PNP BIPOLAR BCX17... 45V 100MHz 425mW 500mA MARKING CODE T1, SURFACE MOUNTED, SOT-23,	MOTOROLA INC.	BCX17
TR110	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR111	28487/823	TRANSISTOR NPN BIPOLAR AT-64020.. 20V 4.0GHz 200mA GAIN 10dB @ 2GHz, 28dBm O/P POWR, SURFACE MOUNTED,	AVANTEK (US) INC	AT-64020
TR201	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR202	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR203	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR204	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR205	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR206	28487/823	TRANSISTOR NPN BIPOLAR AT-64020.. 20V 4.0GHz 200mA GAIN 10dB @ 2GHz, 28dBm O/P POWR, SURFACE MOUNTED,	AVANTEK (US) INC	AT-64020
TR207	28459/211	TRANSISTOR GALLIUM-ARSENIDE MESFET ATF10736.. 5V 0.5-12GHz, 100mW 130mA 12.5dB GAIN,	AVANTEK (US) INC	ATF-10736
TR208	28459/211	TRANSISTOR GALLIUM-ARSENIDE MESFET ATF10736.. 5V 0.5-12GHz, 100mW 130mA 12.5dB GAIN,	AVANTEK (US) INC	ATF-10736
TR209	28459/211	TRANSISTOR GALLIUM-ARSENIDE MESFET ATF10736.. 5V 0.5-12GHz, 100mW 130mA 12.5dB GAIN,	AVANTEK (US) INC	ATF-10736
TR210	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR211	28435/241	TRANSISTOR PNP BIPOLAR BCX17... 45V 100MHz 425mW 500mA MARKING CODE T1, SURFACE MOUNTED, SOT-23,	MOTOROLA INC.	BCX17
TR301	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR302	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR303	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR304	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/4 Quadrupler board (contd.)				
TR305	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR401	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR402	28459/211	TRANSISTOR GALLIUM-ARSENIDE MESFET ATF10736.. 5V 0.5-12GHz, 100mW 130mA 12.5dB GAIN,	AVANTEK (US) INC	ATF-10736
TR403	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR404	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR405	28435/238	TRANSISTOR PNP BIPOLAR BD136.... 45V 75MHz 8W 1.5A 25hFE @ 5mA, TO-126.	NAT. SEMICONDUCTOR	BD136
TR406	28459/207	TRANSISTOR GALLIUM-ARSENIDE FET ATF-45101... 3V 2-10GHz 500mW SURFACE MOUNTED, CASE-AVANTEK-100.	AVANTEK (US) INC	ATF-45101
TR407	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR408	28433/828	TRANSISTOR PNP BIPOLAR BC858B.... 30V 150MHz 200mW 100mA 220hFE @ 2mA, MARKING CODE 3K, SURFACE	PHILIPS	BC858B
TR409	28435/238	TRANSISTOR PNP BIPOLAR BD136.... 45V 75MHz 8W 1.5A 25hFE @ 5mA, TO-126.	NAT. SEMICONDUCTOR	BD136
TR410	28459/206	TRANSISTOR GALLIUM-ARSENIDE FET STF 91-3078.. 3V 2-8GHz 1W SPECIAL-MI SELECTED WAFER, SURFACE	AVANTEK (US) INC	STF 91-3078
	43137/318	RIBBON-LEAD 20 WAY, SOCKET 20 WAY, KEY POS 5, - SKXJ to AT10	MARCONI INSTRUMENTS LTD	
	43137/962	RF-CABLE SEMI-RIGID UT85, 50 OHMS, UNTERMINATED - PLBR to SKBL, AB2/2	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AB3/5 Frequency doubler board

Issue 7

When ordering, prefix circuit reference with AB3/5.

	44829/772	Complete unit		
C1	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C2	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C3	26386/838	CAPACITOR FIXED CERAMIC 1.5nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210J050-0152J-C-C09
C4	26386/838	CAPACITOR FIXED CERAMIC 1.5nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210J050-0152J-C-C09
C5	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C6	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C7	26458/065	CAPACITOR FIXED ALUMINIUM 4.7uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.7 x 7.9mm,	PHILIPS	2222-127-25478
C8	26458/065	CAPACITOR FIXED ALUMINIUM 4.7uF +/-20% 16V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.7 x 7.9mm,	PHILIPS	2222-127-25478
C9	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C10	26386/950	CAPACITOR FIXED CERAMIC 1nF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 1206, NICKEL	AVX LTD	1206 5A 102 JAT 00 J
C11	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C12	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C13	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C14	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C15	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C16	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C17	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C18	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C19	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C20	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C21	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C24	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C25	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/5	**Frequency doubler board (contd.)**			
C26	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C27	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C28	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C29	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C30	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C31	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C32	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C33	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C34	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C35	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C36	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C37	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C38	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C39	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C41	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C44	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C45	26343/784	CAPACITOR FIXED CERAMIC 68pF +/-5% 50V NPO MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 680 JAT 00 J
C46	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C47	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C50	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C51	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C53	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C54	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C55	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C56	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C57	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/5 Frequency doubler board (contd.)				
C58	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C59	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C61	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C62	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C63	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C64	26386/875	CAPACITOR FIXED CERAMIC 10nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5C 103 KA6 CV J
C65	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
C66	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
D1	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D2	28335/670	DIODE BAND SWITCHING, BAT18... 35V 100mA 1.2Vf @ 100mA, MARKING CODE A2, SURFACE MOUNTED, SOT-23,	PHILIPS	BAT18/T1
D3	28371/417	DIODE ZENER, BZX79-C5V6... 500mW 5.6V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V6
D4	28371/417	DIODE ZENER, BZX79-C5V6... 500mW 5.6V 5% 250mA AXIAL, DO-35, (TAPED).	MOTOROLA INC.	BZX79-C5V6
D5	28349/024	DIODE MIXER/DETECTOR, SCHOTTKY, DME3040... QUAD, 0.5pF 0.4Vf @ 1mA, S-BAND, MEDIUM-DRIVE, RING CCT,	ALPHA INDUSTRIES INC	DME3040
D6	28349/022	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2812... DUAL, 20V 1A 0.41Vf @ 1mA, MARKED B2, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2812-L31
D7	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D8	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D9	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D10	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D11	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D12	28383/962	DIODE PIN, BAR60... TRIPLE, 100V 0.25pF 1.05Vf @ 100mA, T-CIRCUIT, MARKING CODE 60, SURFACE	SIEMENS LTD	BAR60
D16	28383/902	DIODE SMALL-SIGNAL, BAW56... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON ANODE, MARKING CODE A1, SURFACE	PHILIPS	BAW56 (A1)
D17	28349/022	DIODE SMALL-SIGNAL, SCHOTTKY, HSMS-2812... DUAL, 20V 1A 0.41Vf @ 1mA, MARKED B2, LOW PROFILE,	HEWLETT-PACKARD	HSMS-2812-L31
D19	28349/025	DIODE MIXER/DETECTOR, SCHOTTKY, 5082-2209... 125mW 4V MEDIUM BARRIER, STRIPLINE TYPE, SUBSTRATE	HEWLETT-PACKARD	5082-2209

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/5 Frequency doubler board (contd.)				
IC1	28461/388	IC ANALOGUE OPERATIONAL AMP LM324D... QUAD, GENERAL PURPOSE, LINEAR, BIPOLAR, 14 PIN,	MOTOROLA INC.	LM324D
IC2	28461/388	IC ANALOGUE OPERATIONAL AMP LM324D... QUAD, GENERAL PURPOSE, LINEAR, BIPOLAR, 14 PIN,	MOTOROLA INC.	LM324D
IC3	28465/056	IC DIGITAL DECODER/DEMULTIPLEX 74HC139.. 2 INPUT, 4 BIT, DUAL, INVERTING, 1 BIT ADDRESS,	HARRIS SEMICONDUCTOR	CD74HC139M
IC4	28461/388	IC ANALOGUE OPERATIONAL AMP LM324D... QUAD, GENERAL PURPOSE, LINEAR, BIPOLAR, 14 PIN,	MOTOROLA INC.	LM324D
IC5	28461/412	IC ANALOGUE OPERATIONAL AMP TL072... DUAL, 18V 3.0MHz BANDWIDTH, INPUT VOLTAGE RANGE +/-15V TYP,	MOTOROLA INC.	TL072CD
L10	23642/423	INDUCTOR FIXED 10uH +/- 10% MOULDED-EPOXY, MINIATURE, 180mA 3R7 MAX, 55 Q @ 7.9 MHz, 46 MHz	SIGMA PRODUCTS LTD	30-10-2525-10
L11	23642/423	INDUCTOR FIXED 10uH +/- 10% MOULDED-EPOXY, MINIATURE, 180mA 3R7 MAX, 55 Q @ 7.9 MHz, 46 MHz	SIGMA PRODUCTS LTD	30-10-2525-10
L12	23642/418	INDUCTOR FIXED 0.1uH +/- 10% MOULDED-EPOXY, MINIATURE, 1.24A 0R08 MAX, 35 Q @ 25 MHz, 625 MHz	DELEVAN (US)	1025-94
L13	23642/418	INDUCTOR FIXED 0.1uH +/- 10% MOULDED-EPOXY, MINIATURE, 1.24A 0R08 MAX, 35 Q @ 25 MHz, 625 MHz	DELEVAN (US)	1025-94
L14	23642/500	INDUCTOR FIXED 0.22uH +/- 20% MOULDED-EPOXY, 710mA 0R1 MAX, 40 Q @ 25.2 MHz, 150 MHz SRF, SURFACE	BICC-CITEC LTD	3613-A-R22-M
R1	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R2	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R3	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R4	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R5	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R6	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R7	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R8	24338/006	RESISTOR FIXED METAL-GLAZE 220R +/- 5% 1W 100V 300 ppm/DEG.C, SURFACE MOUNTED, SIZE 2512, (TAPED).	VTM (UK) LTD	509-0-221-5%-300PPM
R9	24331/976	RESISTOR FIXED CARBON-COMPOSITION 220R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB2215
R10	24321/805	RESISTOR FIXED METAL-GLAZE 22K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-22K1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2212-FT
R11	24321/745	RESISTOR FIXED METAL-GLAZE 68R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-68R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-68R1-FT
R12	24321/745	RESISTOR FIXED METAL-GLAZE 68R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-68R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-68R1-FT
R13	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/5		**Frequency doubler board (contd.)**		
R14	24321/731	RESISTOR FIXED METAL-GLAZE 18R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-18R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-18R2-FT
R15	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R16	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R17	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R18	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R19	24321/815	RESISTOR FIXED METAL-GLAZE 56K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-56K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-5622-FT
R20	24321/738	RESISTOR FIXED METAL-GLAZE 36R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-36R5-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-36R5-FT
R21	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R22	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R23	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R24	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R25	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R26	24338/002	RESISTOR FIXED METAL-GLAZE 100R +/- 5% 1W 100V 300 ppm/DEG.C, SURFACE MOUNTED, SIZE 2512, (TAPED).	VTM (UK) LTD	509-0-101-5%-300PPM
R27	24331/961	RESISTOR FIXED CARBON-COMPOSITION 180R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB1815
R28	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R29	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R30	24321/742	RESISTOR FIXED METAL-GLAZE 51R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-51R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-51R1-FT
R31	24321/805	RESISTOR FIXED METAL-GLAZE 22K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-22K1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2212-FT
R32	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R33	24331/976	RESISTOR FIXED CARBON-COMPOSITION 220R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB2215
R34	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R35	24321/796	RESISTOR FIXED METAL-GLAZE 9K1 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-9K09-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-9091-FT
R36	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R37	24321/809	RESISTOR FIXED METAL-GLAZE 33K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33K2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3322-FT
R38	24321/837	RESISTOR FIXED METAL-GLAZE 470K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-475K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-4753-FT
R39	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT

AB3/5 Frequency doubler board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R40	24321/740	RESISTOR FIXED METAL-GLAZE 43R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-43R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-43R2-FT
R41	24681/528	RESISTOR NETWORK ISOLATED, THICK-FILM, 10K 2% 480mW 50V 200 ppm/DEG.C, 8 RESISTORS, SURFACE	BOURNS ELECTRONICS	4816P-001-103
R42	24321/735	RESISTOR FIXED METAL-GLAZE 27R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-27R4-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-27R4-FT
R43	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R44	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R45	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R46	24681/526	RESISTOR NETWORK ISOLATED, THICK-FILM, 100R 2% 500mW 25V 200 ppm/DEG.C, 7 RESISTORS, SURFACE	BOURNS ELECTRONICS	4814P-001-101
R48	24321/726	RESISTOR FIXED METAL-GLAZE 11R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-11R0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-11R0-FT
R49	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R50	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R51	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R52	24321/740	RESISTOR FIXED METAL-GLAZE 43R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-43R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-43R2-FT
R53	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R54	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R55	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R56	24321/750	RESISTOR FIXED METAL-GLAZE 110R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-110R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1100-FT
R57	24321/745	RESISTOR FIXED METAL-GLAZE 68R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-68R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-68R1-FT
R58	24321/745	RESISTOR FIXED METAL-GLAZE 68R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-68R1-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-68R1-FT
R61	24321/749	RESISTOR FIXED METAL-GLAZE 100R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-100R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1000-FT
R63	24331/976	RESISTOR FIXED CARBON-COMPOSITION 220R +/- 5% 125mW 150V AXIAL, (LOOSE OR TAPED).	ALLEN-BRADLEY ELECT.	BB2215
R64	24338/006	RESISTOR FIXED METAL-GLAZE 220R +/- 5% 1W 100V 300 ppm/DEG.C, SURFACE MOUNTED, SIZE 2512, (TAPED).	VTM (UK) LTD	509-0-221-5%-300PPM
R65	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R66	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R67	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R68	24321/737	RESISTOR FIXED METAL-GLAZE 33R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-33R2-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-33R2-FT
R72	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB3/5 Frequency doubler board (contd.)				
R73	24321/773	RESISTOR FIXED METAL-GLAZE 1K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K00-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1001-FT
R76	24321/760	RESISTOR FIXED METAL-GLAZE 300R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-301R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-3010-FT
R77	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R78	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R79	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R80	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R81	24321/753	RESISTOR FIXED METAL-GLAZE 150R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150R-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1500-FT
R82	24321/735	RESISTOR FIXED METAL-GLAZE 27R +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-27R4-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-27R4-FT
RLA	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
RLB	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
RLC	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
RLD	23486/101	RELAY MAGNETIC, DOUBLE-POLE CHANGEOVER, 5V COIL, 62R - CONTACTS 1A @ 28VDC, 9.5mmSQ, 9.6mm HIGH,	TELEDYNE LTD	172-5
TR1	28487/807	TRANSISTOR NPN BIPOLAR 42085.... 12V 6GHz 500mW 80mA 30hFE @ 35mA, 20dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-42085
TR2	28487/823	TRANSISTOR NPN BIPOLAR AT-64020.. 20V 4.0GHz 200mA GAIN 10dB @ 2GHz, 28dBm O/P POWR, SURFACE MOUNTED,	AVANTEK (US) INC	AT-64020
TR3	28487/822	TRANSISTOR NPN BIPOLAR LTE42005S.. 18V 4.2GHz 550mW 110mA 7.2dB, SURFACE MOUNTED, CASE-FO-41B.	PHILIPS	LTE42005S
TR4	28435/241	TRANSISTOR PNP BIPOLAR BCX17... 45V 100MHz 425mW 500mA MARKING CODE T1, SURFACE MOUNTED, SOT-23,	MOTOROLA INC.	BCX17
TR5	28435/241	TRANSISTOR PNP BIPOLAR BCX17... 45V 100MHz 425mW 500mA MARKING CODE T1, SURFACE MOUNTED, SOT-23,	MOTOROLA INC.	BCX17
TR6	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR7	28487/807	TRANSISTOR NPN BIPOLAR 42085.... 12V 6GHz 500mW 80mA 30hFE @ 35mA, 20dBm, SURFACE MOUNTED,	AVANTEK (US) INC	AT-42085
TR8	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
	43590/209	WOUND-PART TRANSFORMER, RING-CORE, 12:12 TURNS, TWISTED_BIFILAR_WOUND,_UNMOUNTED.	MARCONI INSTRUMENTS LTD	
	43137/318	RIBBON-LEAD 20 WAY, SOCKET 20 WAY, KEY POS 5, - PLBR to SKBL, AB2/2	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AB4/1 Beat frequency oscillator board

Issue 3

When ordering, prefix circuit reference with AB4/1.

	44829/697	Complete unit		
C1	26343/486	CAPACITOR FIXED CERAMIC 5.6pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09568
C2	26343/577	CAPACITOR FIXED CERAMIC 39pF +/-5% 100V COG/NP0 MULTILAYER, RADIAL, 2.5mm PWP, (LOOSE OR TAPED).	AVX LTD	SR15-1A-390-JAA
C3	26343/578	CAPACITOR FIXED CERAMIC 47pF +/-5% 100V COG, MULTILAYER, RADIAL, 2.5mm PWP, (LOOSE OR TAPED).	AVX LTD	SR15-1A-470-JAA
C4	26343/576	CAPACITOR FIXED CERAMIC 27pF +/-5% 100V NP0 MULTILAYER, RADIAL, 2.5mm PWP, (TAPED).	AVX LTD	SR15-1A270-JAA-TR
C5	26343/486	CAPACITOR FIXED CERAMIC 5.6pF +/-0.25pF 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-09568
C6	26343/432	CAPACITOR FIXED CERAMIC 150pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34151
C7	26343/438	CAPACITOR FIXED CERAMIC 120pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34121
C8	26343/431	CAPACITOR FIXED CERAMIC 82pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34829
C9	26343/433	CAPACITOR FIXED CERAMIC 47pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34479
C10	26343/431	CAPACITOR FIXED CERAMIC 82pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34829
C11	26343/499	CAPACITOR FIXED CERAMIC 27pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34279
C12	26343/493	CAPACITOR FIXED CERAMIC 15pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10159
C13	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C14	26343/489	CAPACITOR FIXED CERAMIC 22pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34229
C15	26383/591	CAPACITOR FIXED CERAMIC 4.7nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51472
C16	26486/233	CAPACITOR FIXED TANTALUM 47uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-D-3-12-47-M-FSPB
C17	26486/233	CAPACITOR FIXED TANTALUM 47uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-D-3-12-47-M-FSPB
C18	26486/233	CAPACITOR FIXED TANTALUM 47uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-D-3-12-47-M-FSPB
C19	26486/233	CAPACITOR FIXED TANTALUM 47uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-D-3-12-47-M-FSPB
C20	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C21	26486/233	CAPACITOR FIXED TANTALUM 47uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-D-3-12-47-M-FSPB
C22	26486/233	CAPACITOR FIXED TANTALUM 47uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	FB-D-3-12-47-M-FSPB
C23	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB4/1 Beat frequency oscillator board (contd.)				
C24	26421/122	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	35 TWMS 100 M
C25	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C26	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C27	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C28	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
C29	26421/115	CAPACITOR FIXED ALUMINIUM 33uF +/-20% 25V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	25-MS7-33-M
C30	26383/585	CAPACITOR FIXED CERAMIC 1nF +/-10% 63V 2C2 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-630-51102
D1	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
L1	23642/045	INDUCTOR FIXED 0.056uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.08A 0R048 MAX, 33 Q @ 25 MHz, 990 MHz	SIGMA PRODUCTS LTD	30-10-2566-10
L2	23642/046	INDUCTOR FIXED 0.068uH +/- 10% MOULDED-EPOXY, MINIATURE, 1.94A 0R055 MAX, 33 Q @ 25 MHz, 900 MHz	SIGMA PRODUCTS LTD	30-10-2567-10
L3	23642/045	INDUCTOR FIXED 0.056uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.08A 0R048 MAX, 33 Q @ 25 MHz, 990 MHz	SIGMA PRODUCTS LTD	30-10-2566-10
L4	23642/042	INDUCTOR FIXED 0.033uH +/- 10% MOULDED-EPOXY, MINIATURE, 2.8A 0R0255 MAX, 33 Q @ 30 MHz, 1.175K	SIGMA PRODUCTS LTD	30-10-2563-10
L11	23642/552	INDUCTOR FIXED 3.3uH +/- 10% COATED-LACQUER, MINIATURE, 350mA 1R6 MAX, 32 Q @ 7.9 MHz, 115 MHz	SIGMA PRODUCTS LTD	10-10-0519-10
L12	44291/019	WOUND-PART INDUCTOR, 6.5mH, POT-CORE, RM6, 200 TURNS, LABELLED.	AMETHYST DESIGNS LTD	AD5244
L15	23642/422	INDUCTOR FIXED 0.68uH +/- 10% MOULDED-EPOXY, MINIATURE, 450mA 0R6 MAX, 28 Q @ 25 MHz, 250 MHz	SIGMA PRODUCTS LTD	30-10-2511-10
R1	24772/043	RESISTOR FIXED METAL-FILM 56R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-56R-G-T-1
R2	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R3	24772/043	RESISTOR FIXED METAL-FILM 56R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-56R-G-T-1
R4	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R5	24772/085	RESISTOR FIXED METAL-FILM 3K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-3K3-G-T-1
R6	24772/079	RESISTOR FIXED METAL-FILM 1K8 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K8-G-T-1

AB4/1 Beat frequency oscillator board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R7	24772/037	RESISTOR FIXED METAL-FILM 33R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-33R-G-T-1
R8	24772/054	RESISTOR FIXED METAL-FILM 160R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-160R-G-T-1
R9	24772/054	RESISTOR FIXED METAL-FILM 160R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-160R-G-T-1
R10	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R11	24772/067	RESISTOR FIXED METAL-FILM 560R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-560R-G-T-1
R12	24772/062	RESISTOR FIXED METAL-FILM 360R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-360R-G-T-1
R13	24573/047	RESISTOR FIXED METAL-OXIDE 82R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-82R-2%
R14	24772/025	RESISTOR FIXED METAL-FILM 10R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10R-G-T-1
R15	24773/239	RESISTOR FIXED METAL-FILM 39R +/- 2% 250mW 250V 100 ppm/DEG.C, AXIAL, (TAPED).	ROHM ELECTRONICS LTD	CRB25-G-X-39R
R16	24772/070	RESISTOR FIXED METAL-FILM 750R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-750R-G-T-1
R17	24772/099	RESISTOR FIXED METAL-FILM 12K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-12K-G-T-1
R18	24772/025	RESISTOR FIXED METAL-FILM 10R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10R-G-T-1
R19	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R20	24772/061	RESISTOR FIXED METAL-FILM 330R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-330R-G-T-1
R21	24772/017	RESISTOR FIXED METAL-FILM 4R7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	BEYSCHLAG (GERMANY)	MBA0204-00-BX-4R7-2%
R22	24772/017	RESISTOR FIXED METAL-FILM 4R7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	BEYSCHLAG (GERMANY)	MBA0204-00-BX-4R7-2%
R23	24772/025	RESISTOR FIXED METAL-FILM 10R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10R-G-T-1
R24	24772/042	RESISTOR FIXED METAL-FILM 51R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-51R-G-T-1
R25	24772/025	RESISTOR FIXED METAL-FILM 10R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10R-G-T-1
R26	24772/065	RESISTOR FIXED METAL-FILM 470R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-470R-G-T-1
R27	25685/403	THERMISTOR NEGATIVE-TC DISC, 10mm 33R @ 25 DEG.C, 10% RADIAL.	BOWTHORPE THERMISTRS	KED330CY
R28	24573/032	RESISTOR FIXED METAL-OXIDE 20R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	WELWYN ELECTRONICS	MFR5-20R-2%
R29	24573/032	RESISTOR FIXED METAL-OXIDE 20R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	WELWYN ELECTRONICS	MFR5-20R-2%

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AB4/1	**Beat frequency oscillator board (contd.)**			
TR1	28452/172	TRANSISTOR NPN BIPOLAR BFR96S.... 15V 5GHz 700mW 100mA 25hFE @ 70mA, SURFACE MOUNTED, SOT-37.	PHILIPS	BFR96S
TR2	28452/172	TRANSISTOR NPN BIPOLAR BFR96S.... 15V 5GHz 700mW 100mA 25hFE @ 70mA, SURFACE MOUNTED, SOT-37.	PHILIPS	BFR96S
TR3	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR4	28452/248	TRANSISTOR NPN BIPOLAR BFQ34T.... 18V 3GHz 1W 150mA 25hFE @ 100mA, SURFACE MOUNTED, SOT-37.	PHILIPS	BFQ34T
X1	28531/008	RF-MIXER DOUBLE-BALANCED, DIODE RING, TAK-1H.. 2-500MHz, 50R 15 dBm RF-1dB COMPRESS, 6 dB LOSS,	MINI-CIRCUITS	TAK-1H

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AF1 Key matrix board

Issue 4

When ordering, prefix circuit reference with AF1.

	44829/548	Complete unit		
SA	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SB	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SC	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SD	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SE	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SF	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SG	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SH	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SJ	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SK	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SL	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SM	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SN	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SP	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SR	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SS	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
ST	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SU	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SV	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SW	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SX	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SY	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SZ	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AF1	**Key matrix board (contd.)**			
SAA	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAB	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAC	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAD	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAE	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SA F	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAG	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAH	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAJ	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAK	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAL	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAM	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAN	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAP	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAR	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAS	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
SAT	23465/211	SWITCH-PART CONTACT-DOME, ELASTOMERIC, WITH CARBON CENTRE, 9.9mm LONG, 9.9mm WIDE, RUBBER.	HARBORO RUBBER LTD	13708 100 KP109 KRY
	37591/358	MOULDED-PART ABS, SWITCH CAP SMALL, MID-GREY, MOULDED-PART ABS, SWITCH CAP SMALL, MID-GREY,	MARCONI INSTRUMENTS LTD	
	37591/359	SWITCH-CAP-MARKED "1", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/360	SWITCH-CAP-MARKED "2", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/361	SWITCH-CAP-MARKED "3", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/362	SWITCH-CAP-MARKED "4", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/363	SWITCH-CAP-MARKED "5", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/364	SWITCH-CAP-MARKED "6" OR "9", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/365	SWITCH-CAP-MARKED "7", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AF1	**Key matrix board (contd.)**			
	37591/366	SWITCH-CAP-MARKED "8", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/367	SWITCH-CAP-MARKED "0", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/368	SWITCH-CAP-MARKED ".", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/369	SWITCH-CAP-MARKED "-", DARK-GREY ON LIGHT-GREY, 1.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/370	SWITCH-CAP-MARKED "GHz V", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/371	SWITCH-CAP-MARKED "MHz mV", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/372	SWITCH-CAP-MARKED "kHz uV", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/373	SWITCH-CAP-MARKED "Hz dB", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/374	SWITCH-CAP-MARKED WITH UP OR DOWN ARROW SYMBOL, DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 9.75mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/375	SWITCH-CAP-MARKED "KNOB UP-DN", DARK-GREY ON LIGHT-GREY,_11.14mm_LONG,_9.75mm_WIDE.	MARCONI INSTRUMENTS LTD	
	37591/377	SWITCH-CAP-MARKED "CARR ON-OFF", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 12.5mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/378	SWITCH-CAP-MARKED "MOD ON-OFF", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 12.5mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/381	SWITCH-CAP-MARKED "SWEEP", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 12.5mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/382	SWITCH-CAP-MARKED "MEM", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 12.5mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/383	SWITCH-CAP-MARKED "UTIL", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 12.5mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/384	SWITCH-CAP-MARKED WITH A TRIANGLE SYMBOL, DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 12.5mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/448	SWITCH-CAP-MARKED "LF", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 12.5mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/449	SWITCH-CAP-MARKED "LF ON-OFF", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 12.5mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/468	SWITCH-CAP-MARKED "SIG GEN", DARK-GREY ON LIGHT-GREY, 11.14mm LONG, 12.5mm WIDE.	MARCONI INSTRUMENTS LTD	
	37591/560	MOULDED-PART NYLON, KEYCAP HOUSING, LOW PROFILE, NATURAL_COLOUR,_11.9mm_SQUARE,_9mm_HIGH._	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AF2/1 Front panel control board

Issue 3

When ordering, prefix circuit reference with AF2/1.

	44829/782	Complete unit		
C1	26343/499	CAPACITOR FIXED CERAMIC 27pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34279
C2	26343/499	CAPACITOR FIXED CERAMIC 27pF +/-2% 63V N150 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-34279
C3	26421/112	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-10-M
C4	26421/112	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-10-M
C5	26421/112	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-10-M
C6	26343/492	CAPACITOR FIXED CERAMIC 10pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10109
C7	26343/492	CAPACITOR FIXED CERAMIC 10pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10109
C8	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C9	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C10	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C11	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C12	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C13	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C14	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C15	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C16	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C17	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C18	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C19	26421/112	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-10-M
C20	26421/112	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-10-M
C21	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C22	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C23	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AF2/1	**Front panel control board (contd.)**			
		- Note that programmed EPROMs are to be found at the end of this IC section -		
IC1	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC2	28467/080	IC MICRO CONTROLLER, 80C31... 8 BIT, 12MHz, 128 BYTE RAM, ZERO ROM, DUPLEX UART/SERIAL PORT, 4 x 8	ADVANCED MICRO DEV	P80C31BH
IC3	28465/040	IC DIGITAL DECODER/DEMULTIPLEX 74HC138.. 3 INPUT, 8 BIT, SINGLE, INVERTING, 3 BIT ADDRESS,	HARRIS SEMICONDUCTOR	CD74HC138E
IC4	28462/428	IC DIGITAL LATCH 74HC573.. OCTAL, TRI-STATE, NON-INVERTING, TRANSPARENT, D-TYPE, CMOS-H/SPEED,	HARRIS SEMICONDUCTOR	CD74HC573E
IC5	28462/625	IC DIGITAL FLIP-FLOP/D-TYPE 74HC377... OCTAL, POS EDGE TRIGGER WITH DATA ENABLE, CMOS-H/SPEED, 20	HARRIS SEMICONDUCTOR	CD74HC377E
IC6	28461/347	IC ANALOGUE OPERATIONAL AMP TL071CP... SINGLE, JFET-INPUT, LINEAR, 8 PIN, DUAL-IN-LINE.	MOTOROLA INC.	TL071CP
IC7	28466/365	IC DIGITAL NAND-GATE 74HC00... 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC00E
IC8	28466/112	IC DIGITAL OR-GATE 74HC32.. 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC32E
IC9	28466/408	IC DIGITAL EXCLUSIVE-OR 74HC86... 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC86E
IC10	28469/035	IC DIGITAL BUFFER/LINE-DRIVER 74HC125.. QUAD, TRI-STATE, LOW ENABLE, CMOS-H/SPEED, 14 PIN,	MOTOROLA INC.	MC74HC125AN
IC11	28466/365	IC DIGITAL NAND-GATE 74HC00... 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC00E
IC13	28467/081	IC MICRO GRAPHICS, 1330... LCD CONTROLLER, CMOS, 60 PIN, FLAT-PACK.	SEIKO-EPSON	SED1330FBA
IC14	28469/323	IC MICRO STATIC-RAM, 32K x 8 BIT, 43256-12.. 120nS ACCESS TIME, +5V, NO CLOCK OR TIMING STROBE	SONY (UK) LTD	CXK58256P-12L
IC15	28469/312	IC MICRO STATIC-RAM, 8K x 8 BIT, HM6264P... 150nS, CMOS, 28 PIN, DUAL-IN-LINE.	HITACHI (EUROPE) LTD	HM6264P-15
IC16	28464/143	IC DIGITAL COUNTER 74HC393.. 4 BIT, DUAL, BINARY RIPPLE, CMOS-H/SPEED, 14 PIN, DUAL-IN-LINE.	HARRIS SEMICONDUCTOR	CD74HC393E
IC17	28461/672	IC DIGITAL COMPARATOR 74HC688... SINGLE, 2 x 8 BIT WORDS, CMOS-H/SPEED, 20 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	MM74HC688N
IC18	28461/672	IC DIGITAL COMPARATOR 74HC688... SINGLE, 2 x 8 BIT WORDS, CMOS-H/SPEED, 20 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	MM74HC688N
IC19	28461/921	TRANSISTOR NPN BIPOLAR ULN2001... ARRAY, 50V 500mA 7-DARLINGTON PAIRS, MONOLITHIC, 16 PIN,	ALLEGRO MICROSYSTEMS	ULN2001A
IC12	44533/366	IC PROGRAMMED EPROM (D), SET OF 4	MARCONI INSTRUMENTS LTD	
L1	23642/558	INDUCTOR FIXED 33uH +/- 10% COATED-LACQUER, MINIATURE, 210mA 5R2 MAX, 55 Q @ 2.5 MHz, 20 MHz	SIGMA PRODUCTS LTD	10-10-0531-10
L2	23642/545	INDUCTOR FIXED 0.22uH +/- 10% COATED-LACQUER, MINIATURE, 2.24A 0R04 MAX, 50 Q @ 25 MHz, 400 MHz	SIGMA PRODUCTS LTD	10-10-0505-10
L3	23642/545	INDUCTOR FIXED 0.22uH +/- 10% COATED-LACQUER, MINIATURE, 2.24A 0R04 MAX, 50 Q @ 25 MHz, 400 MHz	SIGMA PRODUCTS LTD	10-10-0505-10
L4	23642/545	INDUCTOR FIXED 0.22uH +/- 10% COATED-LACQUER, MINIATURE, 2.24A 0R04 MAX, 50 Q @ 25 MHz, 400 MHz	SIGMA PRODUCTS LTD	10-10-0505-10

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AF2/1	**Front panel control board (contd.)**			
PLFG	23436/708	CONNECTOR FLEXIBLE CIRCUIT, SOCKET, 14 WAY, RIGHT ANGLED, 1.25mm PITCH, PCB MOUNTING, 2 ROWS OF	MOLEX ELECTRONICS	52044-1410
PLFH	23436/779	CONNECTOR MULTIWAY, PCB HEADER, 10 WAY, STRAIGHT, 2-ROW, 2.54mm GRID, PCB MOUNTING, SOLDER PIN	FUJITSU LTD	FCN-744PO10-AU/R
PLFJ	23436/779	CONNECTOR MULTIWAY, PCB HEADER, 10 WAY, STRAIGHT, 2-ROW, 2.54mm GRID, PCB MOUNTING, SOLDER PIN	FUJITSU LTD	FCN-744PO10-AU/R
PLFK	23436/780	CONNECTOR MULTIWAY, PCB HEADER, 16 WAY, STRAIGHT, 2-ROW, 2.54mm GRID, PCB MOUNTING, SOLDER PIN	FUJITSU LTD	FCN-744PO16-AU/R
PLFL	23435/188	TERMINAL CONNECTOR-PIN, 0.64mm SQUARE, 5.97mm HIGH, PCB-MOUNTING, SINGLE-ENDED, 0.75um GOLD OVER	DU PONT (UK) LTD	75401-001
PLFM	23436/764	CONNECTOR MULTIWAY, PCB HEADER, 2 WAY, STRAIGHT, 2mm PITCH, NYLON BODY, LIGHT BROWN.	JAPAN AVIATION	IL-S-2P-S2T2-EF
PLFP	23436/779	CONNECTOR MULTIWAY, PCB HEADER, 10 WAY, STRAIGHT, 2-ROW, 2.54mm GRID, PCB MOUNTING, SOLDER PIN	FUJITSU LTD	FCN-744PO10-AU/R
R1	24772/095	RESISTOR FIXED METAL-FILM 8K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-8K2-G-T-1
R2	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R3	25685/408	THERMISTOR NEGATIVE-TC DISC, 5mm 15K @ 25 DEG.C, 4.7 %/DEG.C +/- 10% 500mW 2.54mm PWP, RADIAL.	PHILIPS	2322-642-62153
R4	24772/095	RESISTOR FIXED METAL-FILM 8K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-8K2-G-T-1
R5	24772/096	RESISTOR FIXED METAL-FILM 9K1 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-9K1-G-T-1
R6	24772/083	RESISTOR FIXED METAL-FILM 2K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K7-G-T-1
R7	24772/083	RESISTOR FIXED METAL-FILM 2K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K7-G-T-1
R8	24772/083	RESISTOR FIXED METAL-FILM 2K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K7-G-T-1
R9	24772/140	RESISTOR FIXED METAL-FILM 820K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/825K-F-T2
R10	24772/136	RESISTOR FIXED METAL-FILM 430K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	VTM (UK) LTD	GP/490-0/432K-F-T2
R11	24772/129	RESISTOR FIXED METAL-FILM 220K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220K-G-T-1
R12	24772/122	RESISTOR FIXED METAL-FILM 110K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-110K-G-T-1
R13	24772/115	RESISTOR FIXED METAL-FILM 56K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-56K-G-T-1
R14	24772/093	RESISTOR FIXED METAL-FILM 6K8 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-6K8-G-T-1
R15	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R16	24573/067	RESISTOR FIXED METAL-OXIDE 560R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-560R-2%
R17	24573/067	RESISTOR FIXED METAL-OXIDE 560R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-560R-2%
R18	24573/067	RESISTOR FIXED METAL-OXIDE 560R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-560R-2%

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AF2/1	**Front panel control board (contd.)**			
R19	24573/067	RESISTOR FIXED METAL-OXIDE 560R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-560R-2%
R20	24573/059	RESISTOR FIXED METAL-OXIDE 270R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-270R-2%
R21	24573/059	RESISTOR FIXED METAL-OXIDE 270R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-270R-2%
R22	24573/059	RESISTOR FIXED METAL-OXIDE 270R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-270R-2%
R23	24573/059	RESISTOR FIXED METAL-OXIDE 270R +/- 2% 500mW 350V 250 ppm/DEG.C, AXIAL, (TAPED).	WELWYN ELECTRONICS	MFR5-270R-2%
R24	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R25	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R26	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R27	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R28	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R29	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R30	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
R31	24772/057	RESISTOR FIXED METAL-FILM 220R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-220R-G-T-1
TR1	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR2	28452/781	TRANSISTOR NPN BIPOLAR BC208B.... 20V 150MHz 200mW 100mA 290hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	NAT. SEMICONDUCTOR	BC208B
X1	28312/087	CRYSTAL 12 MHz +/- 20 ppm, 20pF PARALLEL RESONANCE, 25R ESR MAX, MICROPROCESSOR	STC COMPONENTS LTD	12MHz/20ppm/4703
X2	28312/047	CRYSTAL 10 MHz +/- 20 ppm, 30pF PARALLEL RESONANCE, 20R ESR MAX, METAL HOLDER, HC-49/U,	STC COMPONENTS LTD	10MHz/20ppm/4703
	43137/381	RIBBON-LEAD 14 WAY, SOCKET 14 WAY, KEY POS 11, - PLFF to AF1	MARCONI INSTRUMENTS LTD	

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AR1 PSU board

Issue 12

When ordering, prefix circuit reference with AR1.

	44829/543	Complete unit		
C1	26421/019	CAPACITOR FIXED ALUMINIUM 100uF +/-20% 10V ELECTROLYTIC, RADIAL, 3.5mm PWP, LOW LEAKAGE WITH	PANASONIC INDUSTRIAL	ECEA 10 M 100uF R
C2	26343/497	CAPACITOR FIXED CERAMIC 12pF +/-2% 63V NP0 SINGLELAYER, RADIAL, 2.5mm PWP, (TAPED).	PHILIPS	2222-678-10129
C3	26422/343	CAPACITOR FIXED ALUMINIUM 10000uF +/-20% 63V ELECTROLYTIC, PCB PIN TERMINATION, 4 RADIAL PINS,	PHILIPS	2222-051-58103
C4	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C5	26421/112	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-10-M
C6	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C7	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C8	26422/342	CAPACITOR FIXED ALUMINIUM 15000uF +/-20% 40V ELECTROLYTIC, PCB PIN TERMINATION, 4 RADIAL PINS,	PHILIPS	2222-051-57153
C9	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C10	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C11	26421/127	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16 TWSS 470 M
C12	26422/342	CAPACITOR FIXED ALUMINIUM 15000uF +/-20% 40V ELECTROLYTIC, PCB PIN TERMINATION, 4 RADIAL PINS,	PHILIPS	2222-051-57153
C13	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C14	26422/341	CAPACITOR FIXED ALUMINIUM 6800uF +/-20% 40V ELECTROLYTIC, PCB PIN TERMINATION, 4 RADIAL PINS,	PHILIPS	2222-051-57682
C16	26421/127	CAPACITOR FIXED ALUMINIUM 470uF +/-20% 16V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	RUBYCON CAPACITORS	16 TWSS 470 M
C17	26422/340	CAPACITOR FIXED ALUMINIUM 47000uF +/-20% 16V ELECTROLYTIC, PCB PIN TERMINATION, 5 RADIAL PINS,	PHILIPS	2222-051-55473
C18	26383/006	CAPACITOR FIXED CERAMIC 10nF -20/+80% 25V K7004 SINGLELAYER, RADIAL, 5mm PWP, (TAPED).	MURATA ELECTRONICS	DD106-979F-103-Z-50
C19	26421/131	CAPACITOR FIXED ALUMINIUM 2200uF +/-20% 6.3V ELECTROLYTIC, RADIAL, 5mm PWP, (LOOSE OR TAPED).	PHILIPS	2222-035-53222
C20	26582/432	CAPACITOR FIXED POLYESTER 1uF +/-10% 50V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF064 D 0105 KDC
C21	26582/427	CAPACITOR FIXED POLYESTER 470nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF074 D 0474 KDC
C22	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C23	26582/429	CAPACITOR FIXED POLYESTER 100nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014 D 0104 KDC
C24	26421/112	CAPACITOR FIXED ALUMINIUM 10uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-10-M

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AR1	**PSU board (contd.)**			
D1	28359/189	DIODE RECTIFIER, 2KBB20R... BRIDGE, 200V 1.9A 80Vrms @ 1.9A, LEADS ON 5mm PITCH, ENCAPSULATED,	INTERNAT RECTIFIER	2KBB20R
D2	28336/246	DIODE SMALL-SIGNAL, 1N4448... 75V 150mA 1Vf @ 100mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4448
D3	28336/246	DIODE SMALL-SIGNAL, 1N4448... 75V 150mA 1Vf @ 100mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4448
D4	28359/189	DIODE RECTIFIER, 2KBB20R... BRIDGE, 200V 1.9A 80Vrms @ 1.9A, LEADS ON 5mm PITCH, ENCAPSULATED,	INTERNAT RECTIFIER	2KBB20R
D5	28336/246	DIODE SMALL-SIGNAL, 1N4448... 75V 150mA 1Vf @ 100mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4448
D6	28336/246	DIODE SMALL-SIGNAL, 1N4448... 75V 150mA 1Vf @ 100mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4448
D7	28336/246	DIODE SMALL-SIGNAL, 1N4448... 75V 150mA 1Vf @ 100mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4448
D8	28336/246	DIODE SMALL-SIGNAL, 1N4448... 75V 150mA 1Vf @ 100mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4448
D9	28357/028	DIODE RECTIFIER, 1N4004... 400V 1A 1.1Vf @ 1A, AXIAL, SOD-81, (TAPED).	DIODES LTD	1N4004
D10	28336/246	DIODE SMALL-SIGNAL, 1N4448... 75V 150mA 1Vf @ 100mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4448
D11	28336/676	DIODE SMALL-SIGNAL, 1N4148... 75V 110mA 1Vf @ 10mA, AXIAL, DO-35, (TAPED).	ITT SEMICONDUCTORS	1N4148
IC1	28467/062	IC MICRO REAL-TIME-CLOCK, PCF8573P... SERIAL INPUT/OUTPUT, CMOS, 16 PIN, DUAL-IN-LINE.	PHILIPS	PCF8573P
IC2	28461/710	IC ANALOGUE VOLTAGE-REGULATOR 7824... 24V 1A POSITIVE, LINEAR, MONOLITHIC, 3 PIN, TO-220.	MOTOROLA INC.	MC7824CT
IC3	28461/726	IC ANALOGUE VOLTAGE-REGULATOR LM317T... 37V 1.5A POSITIVE ADJUSTABLE, LINEAR, MONOLITHIC, 3 PIN,	TEXAS INSTRUMENTS	LM317KC
IC4	28461/322	IC ANALOGUE OPERATIONAL AMP LM324N... QUAD, LINEAR, MONOLITHIC, 14 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	LM324N
IC5	28461/757	IC ANALOGUE VOLTAGE-REFERENCE AD586... 36V 5V REF +/- 0.020V, OUTPUT DRIFT 25ppm, MONOLITHIC, 8 PIN,	ANALOG DEVICES LTD	AD586JQ
IC6	28461/384	IC ANALOGUE OPERATIONAL AMP LF356N... LINEAR, JFET, 8 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	LF356N
IC7	28461/726	IC ANALOGUE VOLTAGE-REGULATOR LM317T... 37V 1.5A POSITIVE ADJUSTABLE, LINEAR, MONOLITHIC, 3 PIN,	TEXAS INSTRUMENTS	LM317KC
IC8	28461/726	IC ANALOGUE VOLTAGE-REGULATOR LM317T... 37V 1.5A POSITIVE ADJUSTABLE, LINEAR, MONOLITHIC, 3 PIN,	TEXAS INSTRUMENTS	LM317KC
IC9	28461/322	IC ANALOGUE OPERATIONAL AMP LM324N... QUAD, LINEAR, MONOLITHIC, 14 PIN, DUAL-IN-LINE.	NAT. SEMICONDUCTOR	LM324N
IC10	28461/726	IC ANALOGUE VOLTAGE-REGULATOR LM317T... 37V 1.5A POSITIVE ADJUSTABLE, LINEAR, MONOLITHIC, 3 PIN,	TEXAS INSTRUMENTS	LM317KC
PLRG	23436/779	CONNECTOR MULTIWAY, PCB HEADER, 10 WAY, STRAIGHT, 2-ROW, 2.54mm GRID, PCB MOUNTING, SOLDER PIN	FUJITSU LTD	FCN-744PO10-AU/R

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AR1	**PSU board (contd.)**			
R1	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R2	24772/092	RESISTOR FIXED METAL-FILM 6K2 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-6K2-G-T-1
R3	24772/058	RESISTOR FIXED METAL-FILM 240R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-240R-G-T-1
R4	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R5	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R6	24772/088	RESISTOR FIXED METAL-FILM 4K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K3-G-T-1
R7	24772/103	RESISTOR FIXED METAL-FILM 18K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-18K-G-T-1
R8	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R9	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-33K-G-T-1
R10	25683/406	THERMISTOR NEGATIVE-TC DISC, 4.6mm 12K @ 25 DEG.C, 4.2 %/DEG.C +/- 7% 250mW 2.5mm PWP, RADIAL.	PHILIPS	2322-640-90004
R11	24772/121	RESISTOR FIXED METAL-FILM 100K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100K-G-T-1
R12	25683/407	THERMISTOR NEGATIVE-TC DISC, 18.2mm 12K @ 25 DEG.C, 4.2 %/DEG.C +/- 7% 250mW 2.5mm PWP, WITH	PHILIPS	2322-640-98004
R13	25133/033	RESISTOR FIXED WIREWOUND 0R33 +/- 10% 1.5W 100V 200 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	ERG COMPONENTS LTD	74EV-0R33-K
R14	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R15	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R16	24772/089	RESISTOR FIXED METAL-FILM 4K7 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K7-G-T-1
R17	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R18	24772/108	RESISTOR FIXED METAL-FILM 30K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-30K-G-T-1
R19	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R20	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R21	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R22	24772/058	RESISTOR FIXED METAL-FILM 240R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-240R-G-T-1
R23	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-22K-G-T-1
R24	25123/020	RESISTOR FIXED WIREWOUND 10R +/- 5% 1.5W 100V 200 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	ERG COMPONENTS LTD	74EV-10R-J
R25	24784/002	RESISTOR FIXED METAL-TAPE 0R047 +/- 5% 3W 60V 600 ppm/DEG.C, LOW-INDUCTANCE, AXIAL, (LOOSE OR	VTM (UK) LTD	KN/350-8/0R047-J-T0
R26	24772/034	RESISTOR FIXED METAL-FILM 24R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-24R-G-T-1

Cir. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AR1	**PSU board (contd.)**			
R27	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-22K-G-T-1
R28	24772/044	RESISTOR FIXED METAL-FILM 62R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-62R-G-T-1
R29	24772/055	RESISTOR FIXED METAL-FILM 180R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-180R-G-T-1
R30	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R31	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R32	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R33	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R34	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-22K-G-T-1
R35	24772/071	RESISTOR FIXED METAL-FILM 820R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-820R-G-T-1
R36	24784/002	RESISTOR FIXED METAL-TAPE 0R047 +/- 5% 3W 60V 600 ppm/DEG.C, LOW-INDUCTANCE, AXIAL, (LOOSE OR	VTM (UK) LTD	KN/350-8/0R047-J-T0
R37	24772/049	RESISTOR FIXED METAL-FILM 100R +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-100R-G-T-1
R38	24772/105	RESISTOR FIXED METAL-FILM 22K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-22K-G-T-1
R39	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R40	24772/097	RESISTOR FIXED METAL-FILM 10K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-10K-G-T-1
R41	24772/088	RESISTOR FIXED METAL-FILM 4K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K3-G-T-1
R42	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R43	24772/080	RESISTOR FIXED METAL-FILM 2K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-2K-G-T-1
R44	24772/128	RESISTOR FIXED METAL-FILM 200K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-200K-G-T-1
R45	24552/006	RESISTOR FIXED METAL-OXIDE 2R7 +/- 5% 500mW 350V 250 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	WELWYN ELECTRONICS	MFR5
R46	24772/073	RESISTOR FIXED METAL-FILM 1K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-1K-G-T-1
R47	24582/555	RESISTOR FIXED METAL-OXIDE 1R +/- 10% 500mW 350V 250 ppm/DEG.C, AXIAL, (LOOSE OR TAPED).	WELWYN ELECTRONICS	MFR5-1R-5%
R48	24772/088	RESISTOR FIXED METAL-FILM 4K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K3-G-T-1
R49	24772/088	RESISTOR FIXED METAL-FILM 4K3 +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-4K3-G-T-1
TR1	28459/070	TRANSISTOR N-CHANNEL-ENHANCE MOSFET SMP60N06-18... 60V 105W 60A 0R018 TO-220.	SILICONIX LTD	SMP60N06-18
TR2	28459/070	TRANSISTOR N-CHANNEL-ENHANCE MOSFET SMP60N06-18... 60V 105W 60A 0R018 TO-220.	SILICONIX LTD	SMP60N06-18

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AR1	**PSU board (contd.)**			
TR3	28459/070	TRANSISTOR N-CHANNEL-ENHANCE MOSFET SMP60N06-18... 60V 105W 60A 0R018 TO-220.	SILICONIX LTD	SMP60N06-18
TR4	28433/455	TRANSISTOR PNP BIPOLAR BC308B.... 20V 130MHz 200mW 100mA 200hFE @ 2mA, TO-92, (TAPED EMITR FIRST).	SIEMENS LTD	BC308B-(Q62702-C286)
TR5	28452/197	TRANSISTOR NPN BIPOLAR 2N2369.... 15V 500MHz 360mW 500mA 40hFE @ 10mA, TO-18.	MOTOROLA INC.	2N2369
XL1	28312/050	CRYSTAL 0.032768 MHz +/- 15 ppm, 12pF PARALLEL RESONANCE, 35K ESR MAX, MAX DIMS - 3mm DIA, 8.2mm	ETA (SWITZERLAND)	DS-26
	23435/736	CONNECTOR MULTIWAY, PCB HEADER, 16 WAY, STRAIGHT, PLRA, PLRB SECONDARIES FROM TRANSFORMER	DU PONT (UK) LTD	75875-101-16

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AR2 Internal frequency standard board — Issue 3

When ordering, prefix circuit reference with AR2.

	44829/550	Complete unit		
C1	26421/108	CAPACITOR FIXED ALUMINIUM 4.7uF +/-20% 35V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	35-MS7-4.7-M
C2	26582/428	CAPACITOR FIXED POLYESTER 47nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014-D-0473-KDC
C3	26582/428	CAPACITOR FIXED POLYESTER 47nF +/-10% 63V 330 ppm/DEG.C, RADIAL, 5mm PWP, (TAPED).	THOMSON COMPONENTS	BF014-D-0473-KDC
C4	26421/106	CAPACITOR FIXED ALUMINIUM 1uF +/-20% 50V ELECTROLYTIC, RADIAL, 5mm PWP, (TAPED).	RUBYCON CAPACITORS	50-MS7-1-M
L1	23642/555	INDUCTOR FIXED 10uH +/- 10% COATED-LACQUER, MINIATURE, 470mA 0R9 MAX, 45 Q @ 7.9 MHz, 45 MHz	SIGMA PRODUCTS LTD	10-10-0525-10
PLRM	23444/334	CONNECTOR-RF SMB-TYPE MALE, RECEPTACLE, 50 OHMS, PCB-MOUNTING, NICKEL PLATED BODY.	GREENPAR (DUBILIER)	B65N07J999X02
R1	24772/109	RESISTOR FIXED METAL-FILM 33K +/- 2% 125mW 150V 100 ppm/DEG.C, AXIAL, (TAPED).	DALE ELECTROSIL LTD	CMF51-33K-G-T-1
X1	44990/377	OCXO OSCILLATOR UNIT (FGS. PART 44990/397)	MARCONI INSTRUMENTS LTD	

AT10 Attenuator assembly (for 2030 & 2031) — Issue 9

When ordering, prefix circuit reference with AT10.

	44429/061	Complete unit

AT10 Attenuator assembly (for 2032) — Issue 8

When ordering, prefix circuit reference with AT10.

	44429/062	Complete unit

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.

AT11 Edgeline controller board

Issue 3

Board cannot be ordered separately, part of AT10.

C1	26386/758	CAPACITOR FIXED CERAMIC 100nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 104 K9 BB
C2	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C3	26386/758	CAPACITOR FIXED CERAMIC 100nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 104 K9 BB
C4	26386/758	CAPACITOR FIXED CERAMIC 100nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 104 K9 BB
C5	26386/883	CAPACITOR FIXED CERAMIC 47nF +/-10% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	SYFER TECHNOLOGY LTD	1210-J-050-0473-K-R
C6	26386/758	CAPACITOR FIXED CERAMIC 100nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 104 K9 BB
C7	26386/758	CAPACITOR FIXED CERAMIC 100nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 104 K9 BB
C8	26386/751	CAPACITOR FIXED CERAMIC 1nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	PHILIPS	0805 2R 102 K9 BB
C9	26386/758	CAPACITOR FIXED CERAMIC 100nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 1210, NICKEL	PHILIPS	1210 2R 104 K9 BB
C10	26386/751	CAPACITOR FIXED CERAMIC 1nF +/-20% 50V X7R/2C1, MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	PHILIPS	0805 2R 102 K9 BB
C12	26458/064	CAPACITOR FIXED ALUMINIUM 47uF +/-20% 6.3V ELECTROLYTIC, SURFACE-MOUNTED, SIZE 6.7 x 7.9mm,	PHILIPS	2222-127-23479
C13	26386/824	CAPACITOR FIXED CERAMIC 100pF +/-5% 50V NP0 MULTILAYER, SURFACE-MOUNTED, SIZE 0805, NICKEL	AVX LTD	0805 5A 101 JAT 00 J
D1	28383/902	DIODE SMALL-SIGNAL, BAW56... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON ANODE, MARKING CODE A1, SURFACE	PHILIPS	BAW56 (A1)
D2	28383/902	DIODE SMALL-SIGNAL, BAW56... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON ANODE, MARKING CODE A1, SURFACE	PHILIPS	BAW56 (A1)
D3	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D4	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D5	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D6	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D7	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D8	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D9	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70
D10	28383/910	DIODE SMALL-SIGNAL, BAS28... DUAL, 330mW 75V 250mA ELECTRICALLY ISOLATED, MARKING CODE A61 OR JT,	PHILIPS	BAS28
D11	28383/901	DIODE SMALL-SIGNAL, BAV70... DUAL, 70V 100mA 1.1Vf @ 50mA, COMMON CATHODE, MARKING CODE A4, SURFACE	PHILIPS	BAV70

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AT11	**Edgeline controller board (contd.)**			
IC1	28469/033	IC DIGITAL BUFFER/LINE-DRIVER 74HCT126... QUAD, TRI-STATE, CMOS-H/SPEED+TTL, 14 PIN,	HARRIS SEMICONDUCTOR	CD74HCT126M
IC2	28469/032	IC DIGITAL INVERTER 74HC14.. HEX, SCHMITT-TRIGGER OPERATION, CMOS-H/SPEED, 14 PIN, SMALL-OUTLINE.	HARRIS SEMICONDUCTOR	CD74HC14M
IC3	28462/640	IC DIGITAL FLIP-FLOP/D-TYPE 74HC175... QUAD, POS EDGE TRIGGER, RESET, CMOS-H/SPEED, 16 PIN,	HARRIS SEMICONDUCTOR	CD74HC175M
IC4	28471/036	IC MICRO EEPROM, 64 x 16 BIT, 93C46... 5V SUPPLY, CMOS, 8 PIN, SMALL-OUTLINE.	INTERNATIONAL CMOS	93C46S
IC5	28462/640	IC DIGITAL FLIP-FLOP/D-TYPE 74HC175... QUAD, POS EDGE TRIGGER, RESET, CMOS-H/SPEED, 16 PIN,	HARRIS SEMICONDUCTOR	CD74HC175M
IC6	28462/639	IC DIGITAL FLIP-FLOP/D-TYPE 74AC374.. 1 INPUT, OCTAL, NON-INVERTING, POS EDGE TRIGGER, TRI-STATE,	NAT. SEMICONDUCTOR	74AC374SC
IC7	28462/639	IC DIGITAL FLIP-FLOP/D-TYPE 74AC374.. 1 INPUT, OCTAL, NON-INVERTING, POS EDGE TRIGGER, TRI-STATE,	NAT. SEMICONDUCTOR	74AC374SC
IC9	28462/640	IC DIGITAL FLIP-FLOP/D-TYPE 74HC175... QUAD, POS EDGE TRIGGER, RESET, CMOS-H/SPEED, 16 PIN,	HARRIS SEMICONDUCTOR	CD74HC175M
IC10	28465/055	IC DIGITAL DECODER/DEMULTIPLEX 74HC138.. 3 INPUT, 8 BIT, SINGLE, INVERTING, 3 BIT ADDRESS,	HARRIS SEMICONDUCTOR	CD74HC138M
IC11	28466/390	IC DIGITAL NAND-GATE 74HC00... 2 INPUT, QUAD, CMOS-H/SPEED, 14 PIN, SMALL-OUTLINE.	HARRIS SEMICONDUCTOR	CD74HC00M
IC12	28469/032	IC DIGITAL INVERTER 74HC14.. HEX, SCHMITT-TRIGGER OPERATION, CMOS-H/SPEED, 14 PIN, SMALL-OUTLINE.	HARRIS SEMICONDUCTOR	CD74HC14M
IC13	28462/638	IC DIGITAL FLIP-FLOP/D-TYPE 74HC74.. 2 BIT, DUAL, POS EDGE TRIGGER, PLUS SET & CLEAR, CMOS-H/SPEED,	HARRIS SEMICONDUCTOR	CD74HC74M
IC14	28461/673	IC ANALOGUE COMPARATOR LM339... QUAD, SINGLE SUPPLY, BIPOLAR, 14 PIN, SMALL-OUTLINE.	HARRIS SEMICONDUCTOR	CA339M
PLTC	23436/779	CONNECTOR MULTIWAY, PCB HEADER, 10 WAY, STRAIGHT, 2-ROW, 2.54mm GRID, PCB MOUNTING, SOLDER PIN	FUJITSU LTD	FCN-744PO10-AU/R
PLTD	23435/120	CONNECTOR MULTIWAY, PCB HEADER, 36 WAY, RIGHT ANGLED, 2.54mm PITCH, STACKABLE, GOLD PLATED POSTS	DU PONT (UK) LTD	75168-101-36
PLTE	23435/120	CONNECTOR MULTIWAY, PCB HEADER, 36 WAY, RIGHT ANGLED, 2.54mm PITCH, STACKABLE, GOLD PLATED POSTS	DU PONT (UK) LTD	75168-101-36
R1	24321/777	RESISTOR FIXED METAL-GLAZE 1K5 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K50-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1501-FT
R2	24321/777	RESISTOR FIXED METAL-GLAZE 1K5 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K50-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1501-FT
R3	24321/825	RESISTOR FIXED METAL-GLAZE 150K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1503-FT
R4	24321/825	RESISTOR FIXED METAL-GLAZE 150K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1503-FT
R5	24321/825	RESISTOR FIXED METAL-GLAZE 150K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1503-FT
R6	24681/526	RESISTOR NETWORK ISOLATED, THICK-FILM, 100R 2% 500mW 25V 200 ppm/DEG.C, 7 RESISTORS, SURFACE	BOURNS ELECTRONICS	4814P-001-101
R7	24681/526	RESISTOR NETWORK ISOLATED, THICK-FILM, 100R 2% 500mW 25V 200 ppm/DEG.C, 7 RESISTORS, SURFACE	BOURNS ELECTRONICS	4814P-001-101

AT11 Edgeline controller board (contd.)

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
R8	24321/825	RESISTOR FIXED METAL-GLAZE 150K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1503-FT
R9	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R10	24321/825	RESISTOR FIXED METAL-GLAZE 150K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-150K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1503-FT
R11	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R14	24321/795	RESISTOR FIXED METAL-GLAZE 8K2 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-8K25-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-8251-FT
R15	24321/781	RESISTOR FIXED METAL-GLAZE 2K2 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K21-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2211-FT
R16	24321/823	RESISTOR FIXED METAL-GLAZE 120K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1213-FT
R17	24321/839	RESISTOR FIXED METAL-GLAZE 680K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-681K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-6813-FT
R18	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R19	24321/783	RESISTOR FIXED METAL-GLAZE 2K7 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K74-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2741-FT
R20	24321/839	RESISTOR FIXED METAL-GLAZE 680K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-681K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-6813-FT
R21	24321/823	RESISTOR FIXED METAL-GLAZE 120K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-121K-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1213-FT
R22	24681/527	RESISTOR NETWORK BUSSED, THICK-FILM, 4K7 2% 600mW 25V 200 ppm/DEG.C, 15 RESISTORS, SURFACE MOUNTED,	SPRAGUE ELECTRIC LTD	836C-472-X2-PE
R23	24321/797	RESISTOR FIXED METAL-GLAZE 10K +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-10K0-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1002-FT
R24	24321/777	RESISTOR FIXED METAL-GLAZE 1K5 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-1K50-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-1501-FT
R25	24321/781	RESISTOR FIXED METAL-GLAZE 2K2 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K21-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2211-FT
R26	24321/781	RESISTOR FIXED METAL-GLAZE 2K2 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K21-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2211-FT
R28	24321/781	RESISTOR FIXED METAL-GLAZE 2K2 +/- 2% 125mW 200V 200 ppm/DEG.C, 1%-2K21-ACCEPTABLE, SURFACE	DALE ELECTROSIL LTD	CRCW-1206-2211-FT
TR1	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR2	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR3	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR4	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR5	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR6	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR7	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40

Clr. Ref.	MI part number	Description	Manufacturer	Manufacturer's part no.
AT11	**Edgeline controller board (contd.)**			
TR8	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR9	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR10	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR11	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR12	28487/811	TRANSISTOR NPN BIPOLAR BC818-40.... 25V 170MHz 330mW 500mA MARKING CODE 6G, SURFACE MOUNTED,	PHILIPS	BC818-40
TR13	28487/812	TRANSISTOR NPN BIPOLAR BST50.... DARLINGTON, 60V 1W 500mA MARKING CODE AS1, SURFACE MOUNTED,	PHILIPS	BST50
TR14	28487/812	TRANSISTOR NPN BIPOLAR BST50.... DARLINGTON, 60V 1W 500mA MARKING CODE AS1, SURFACE MOUNTED,	PHILIPS	BST50

MISCELLANEOUS MECHANICAL PARTS

Item No.	Description	Part Number
	Order without prefix. Item numbers as shown in Fig. 6-2.	
1	Top cover	35906/561
2	Bottom cover	35906/562
3	Retainer moulding, 1 of 2	37591/453
4	Front panel, marked	35906/904
5	Identity strip, 2030	31739/697
	Identity strip, 2031	31739/698
	Identity strip, 2032	31739/699
6	Rear panel, marked	41590/185
7	Knob, control	37591/397
8	Front panel handle, 1 of 2	37591/350
9	Infill, 1 of 2	37591/356
10	Side handle, 1 of 2	41700/734
11	Cover, 1 of 4	35890/229
12	Foot, right-hand lower, 1 of 2	37591/354
13	Foot, left-hand lower, 1 of 2	37591/355
14	Retaining grommet, 1 of 8	23187/104
15	Rear foot,1 of 2	37591/352
16	Plug, 1 of 4	37591/389
17	Foot, tilt, 1 of 2	37591/439
18	Bezel rim	37591/597
19	Glass window	37441/310
20	Blind grommet	22315/809
21	Plug cap & chain, FREQ STD IN/OUT	23433/592
22	Fan finger guard	23535/115

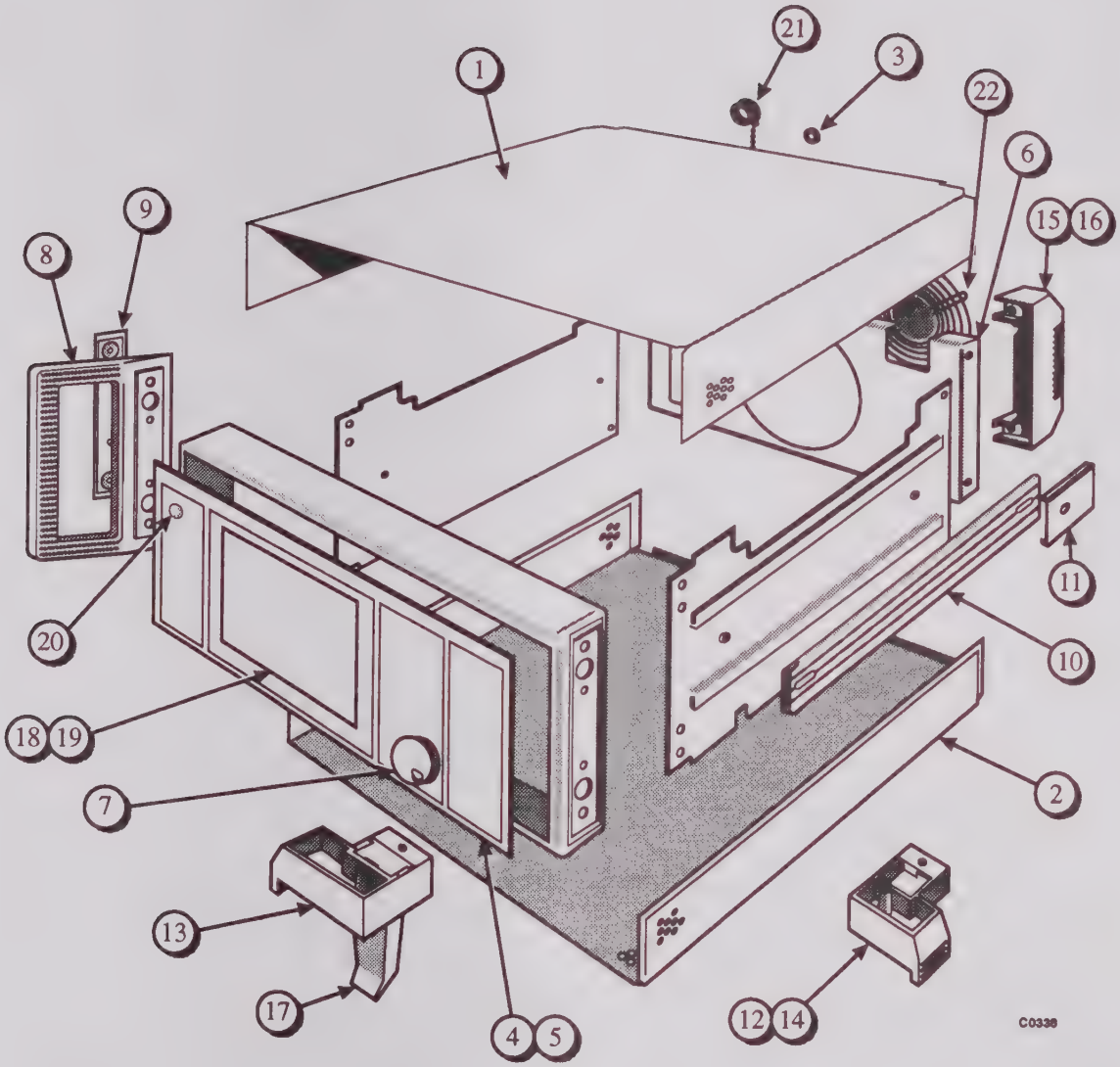

Fig. 6-2 Miscellaneous mechanical parts

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Chapter 7
SERVICING DIAGRAMS

CONTENTS

Circuit notes
- Component values
- Symbols

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7-2	AA1/2	Control: Processor and interface	7-4,5	7-7
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CIRCUIT NOTES

Component values

Resistors : Code letter R = ohms, k = kilohms (10^3), M = megohms (10^6).

Capacitors : Code letter m = millifarads (10^{-3}) μ = microfarads (10^{-6})
n = nanofarads (10^{-9}) p = picofarads (10^{-12}).

Inductors : Code letter H = henrys m = millihenrys (10^{-3})
μ = microhenrys (10^{-6}) n = nanohenrys (10^{-9}).

SIC : Value selected during test, nominal value shown.

Components are marked normally with two, three or four figures according to the accuracy limit, ±10%, ±1% or ±0.1%. The code letter used indicates the multiplier and replaces the decimal point.

Symbols

Symbols are based on BS 3939 with the following additions:-

edge connector

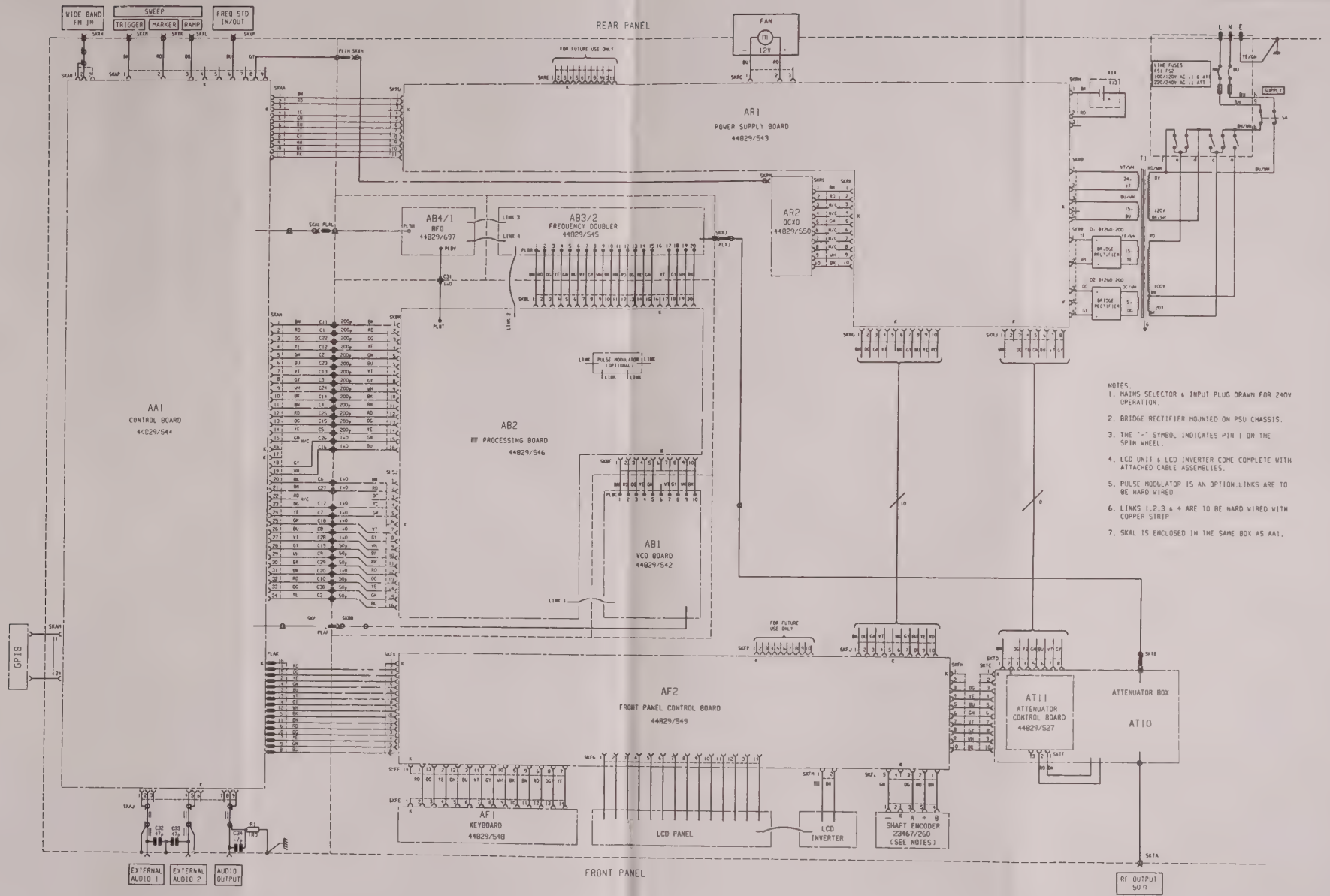
ferrite bead

caution, see page (iv), servicing precautions

A1 unit identification number

p printed component

C0401



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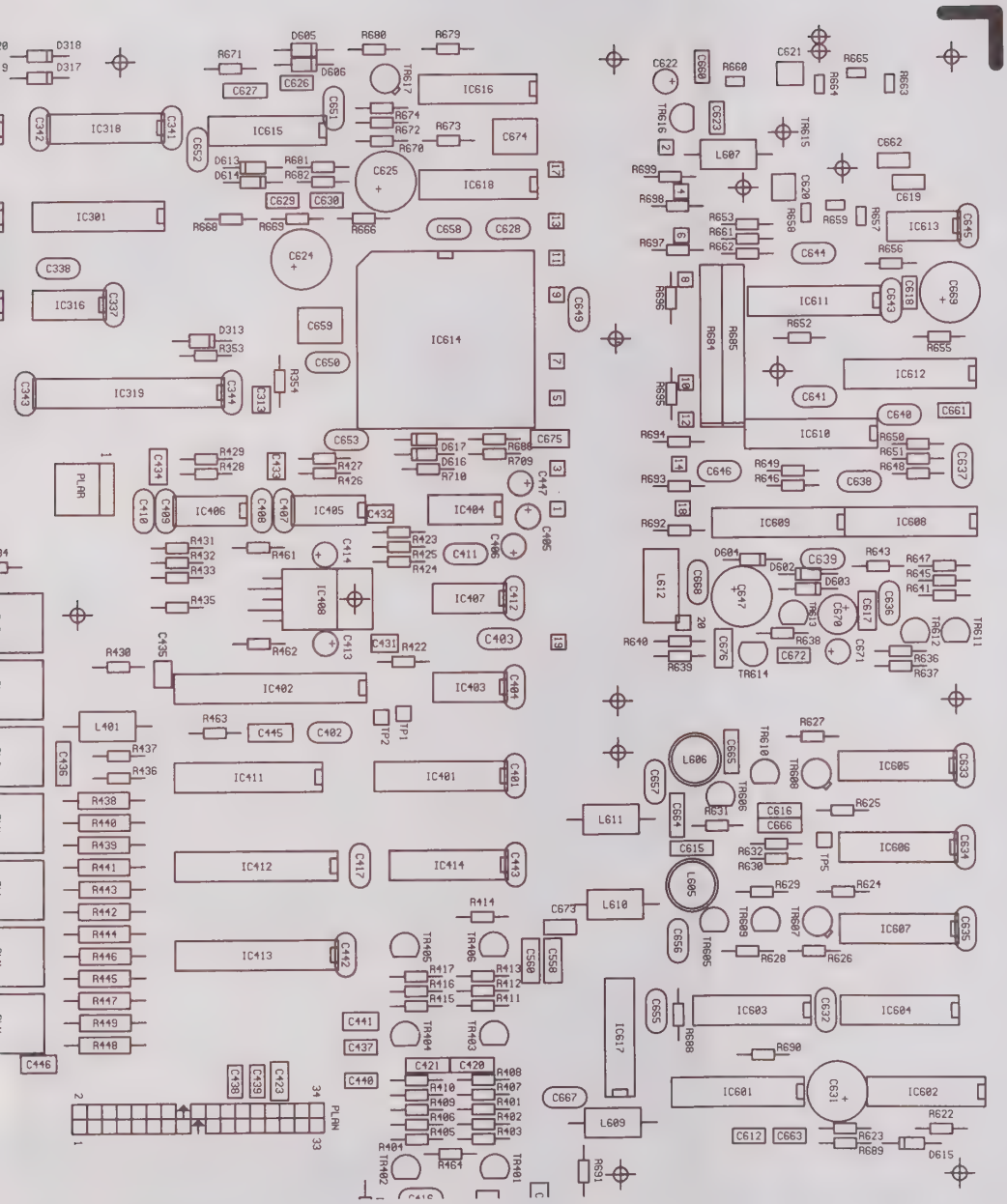
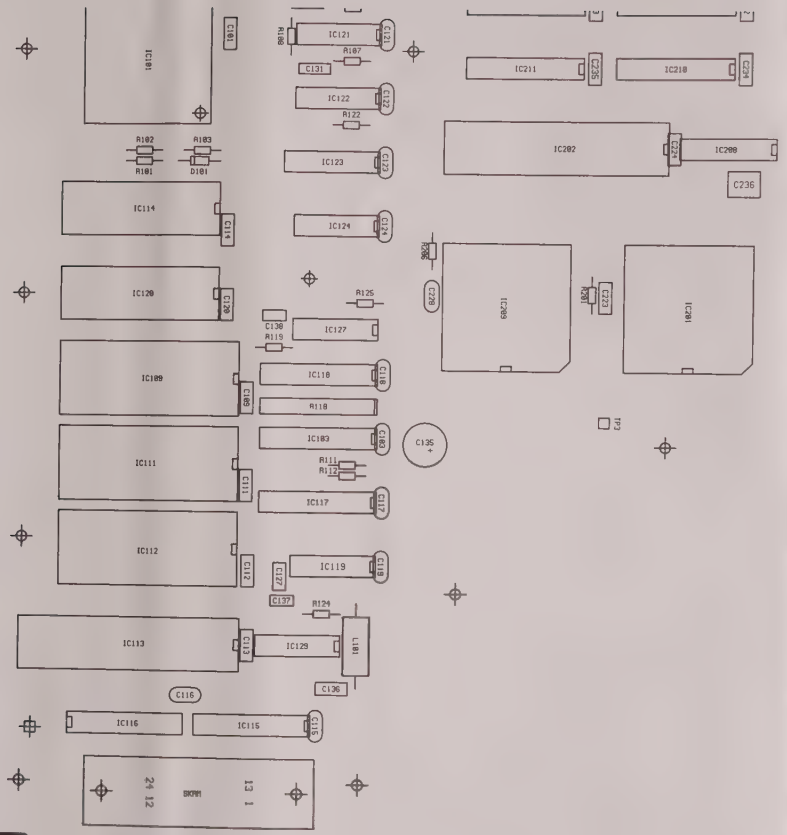
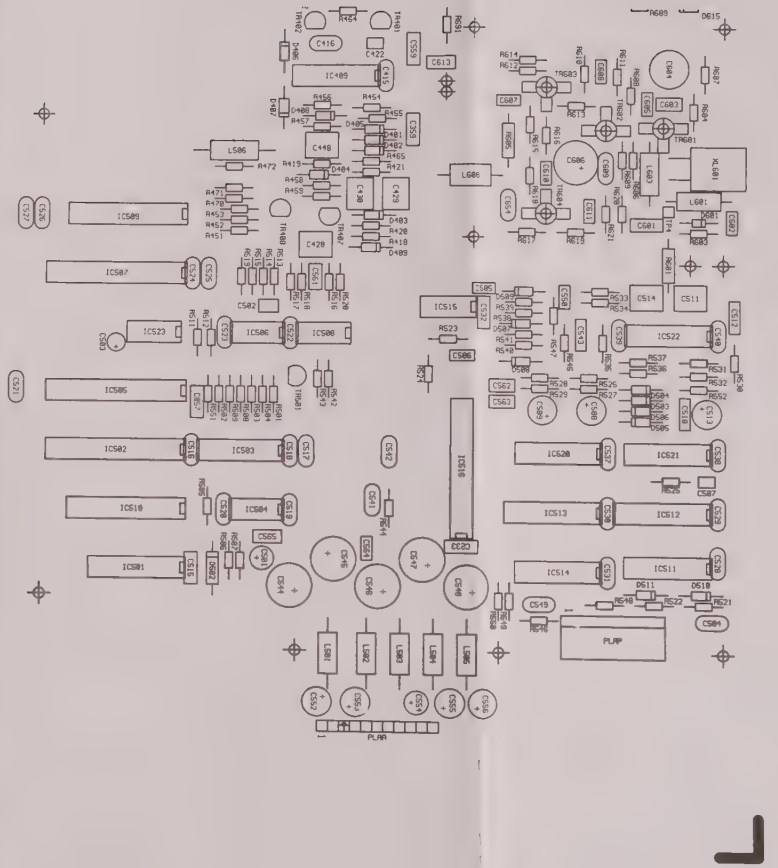
A0

Fig. 7-1 2031 Interconnections







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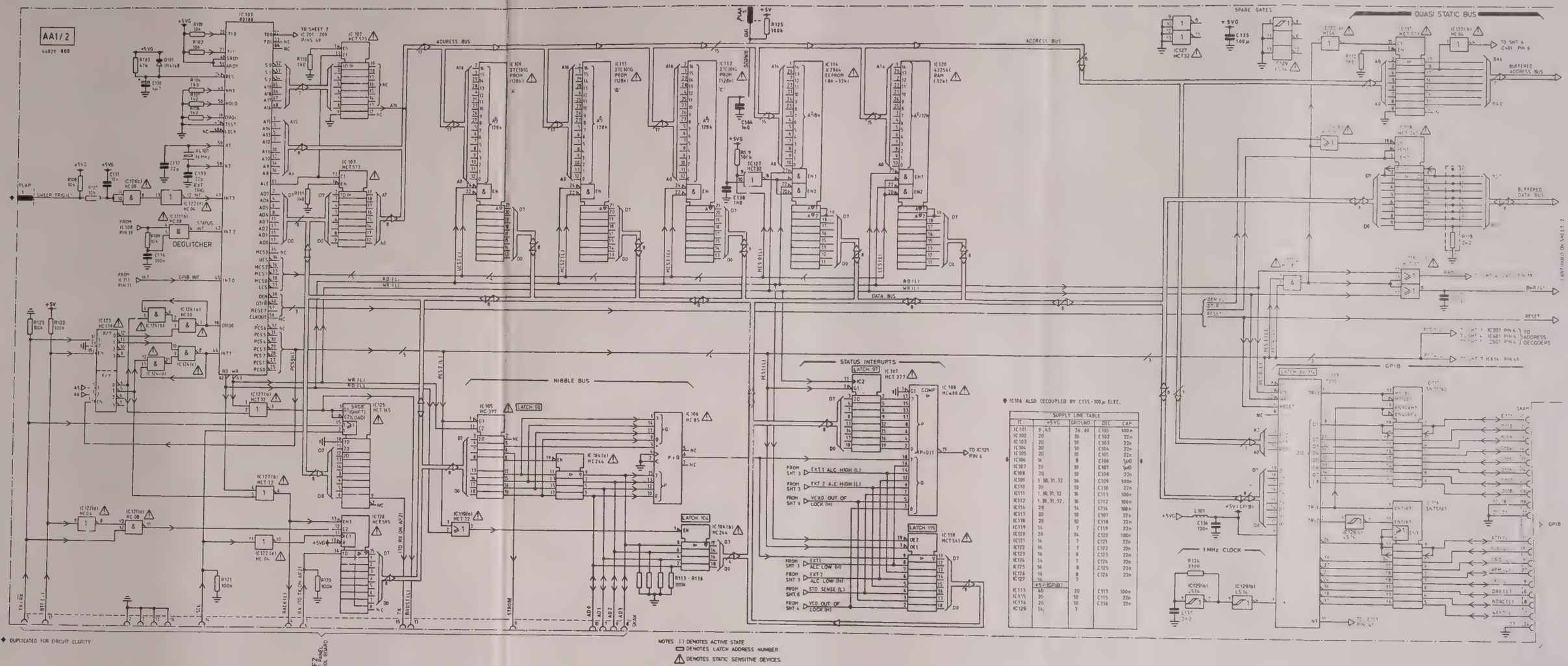
AA1/2
44829 800
IC 101 8088
ADDRESS BUS
DATA BUS
NIBBLE BUS
STATUS INTERUPTS
QUASI STATIC BUS
SPARE GATES
DEGLITCHER
1 MHz CLOCK
SUPPLY LINE TABLE
IC | +5VG | GROUND | DEC | CAP
IC 101 | 9 , 43 | 26 , 60 | C101 | 100n
IC 102 | 20 | 10 | C102 | 22n
IC 103 | 20 | 10 | C103 | 22n
IC 104 | 20 | 10 | C104 | 22n
IC 105 | 20 | 10 | C105 | 22n
IC 106 | 16 | 8 | C106 | 1µ0
IC 107 | 20 | 10 | C107 | 1µ0
IC 108 | 20 | 10 | C108 | 22n
IC 109 | 1 , 30 , 31 , 32 | 16 | C109 | 100n
IC 110 | 20 | 10 | C110 | 22n
IC 111 | 1 , 30 , 31 , 32 | 16 | C111 | 100n
IC 112 | 1 , 30 , 31 , 32 | 16 | C112 | 100n
IC 114 | 28 | 14 | C114 | 100n
IC 117 | 20 | 10 | C107 | 22n
IC 118 | 20 | 10 | C110 | 22n
IC 119 | 14 | 7 | C119 | 22n
IC 120 | 28 | 14 | C120 | 100n
IC 121 | 14 | 7 | C121 | 22n
IC 122 | 14 | 7 | C122 | 22n
IC 123 | 16 | 8 | C123 | 22n
IC 124 | 14 | 7 | C124 | 22n
IC 125 | 16 | 8 | C125 | 22n
IC 126 | 14 | 8 | C126 | 22n
IC 127 | 14 | 7 | | |
+5 / (GPIB) | | | | |
IC 113 | 40 | 20 | C113 | 100n
IC 115 | 20 | 10 | C115 | 22n
IC 116 | 20 | 10 | C116 | 22n
IC 129 | 14 | 7 | | |
* IC106 ALSO DECOUPLED BY C135 - 100 µ ELEC.
DUPLICATED FOR CIRCUIT CLARITY
NOTES (1) DENOTES ACTIVE STATE
DENOTES LATCH ADDRESS NUMBER
DENOTES STATIC SENSITIVE DEVICES.
TO AF2 FRONT PANEL CONTROL BOARD
CONTINUED ON SHEET 7

AA1/2

Fig. 7-2 Control : Processor and interface circuit diagram

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(In general, this circuit diagram also applies to earlier versions of the board.)

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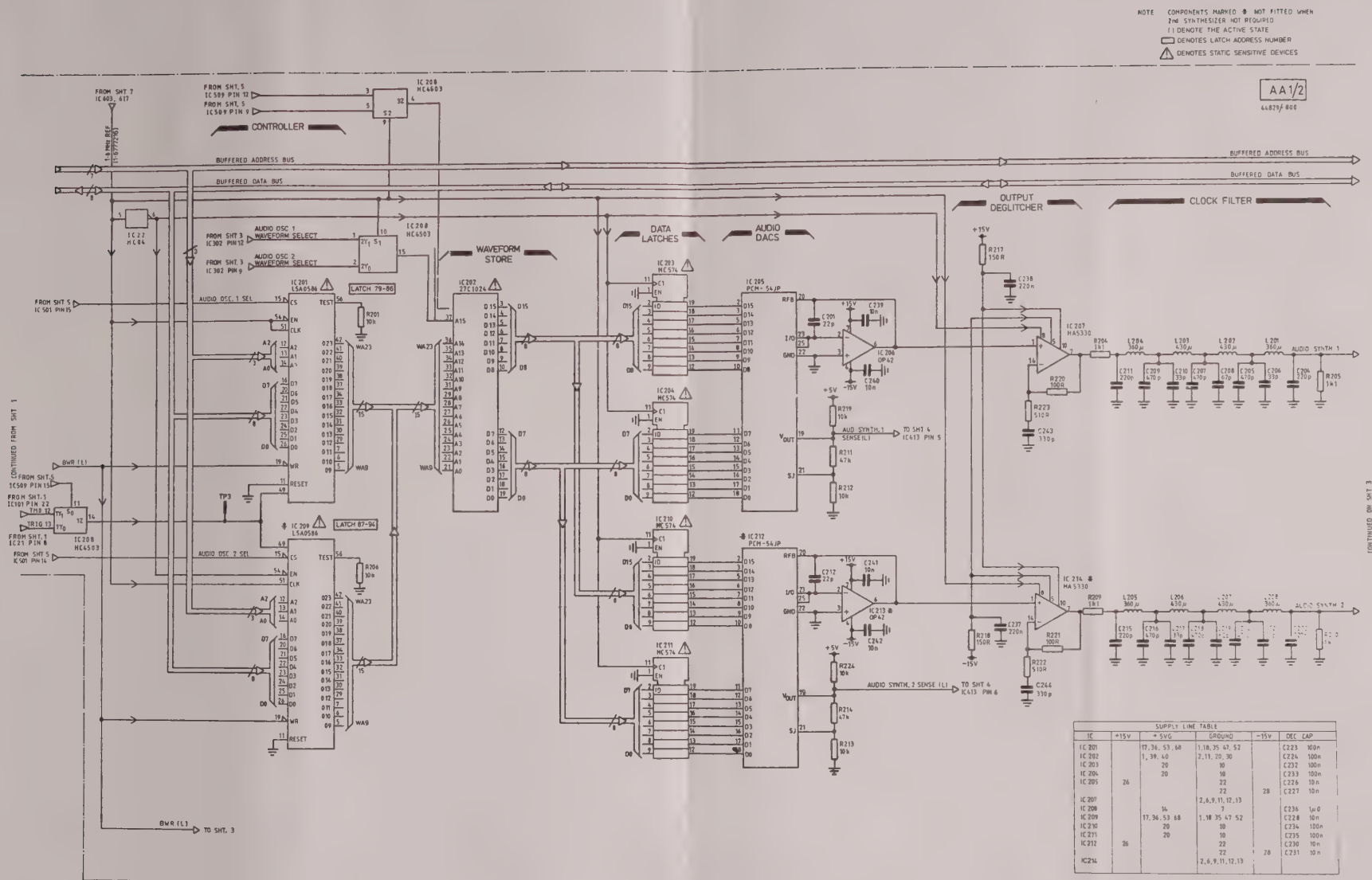
NOTE COMPONENTS MARKED * NOT FITTED WHEN 2nd SYNTHESIZER NOT REQUIRED
( ) DENOTE THE ACTIVE STATE
DENOTES LATCH ADDRESS NUMBER
DENOTES STATIC SENSITIVE DEVICES
AA1/2
44829/800
CONTROLLER
BUFFERED ADDRESS BUS
BUFFERED DATA BUS
OUTPUT DEGLITCHER
CLOCK FILTER
DATA LATCHES
AUDIO DACS
WAVEFORM STORE
AUDIO OSC 1 WAVEFORM SELECT
AUDIO OSC 2 WAVEFORM SELECT
LATCH 79-86
LATCH 87-94
AUDIO OSC 1 SEL
AUDIO OSC 2 SEL
AUDIO SYNTH 1
AUDIO SYNTH 2
AUD SYNTH 1 SENSE (L)
AUDIO SYNTH. 2 SENSE (L)
TO SHT 4 IC413 PIN 5
TO SHT 4 IC413 PIN 6
BWR (L)
TO SHT. 3
CONTINUED FROM SHT 1
CONTINUED ON SHT 3
SUPPLY LINE TABLE
IC | +15V | +5VG | GROUND | -15V | DEC CAP
IC 201 | | 17, 36, 53, 68 | 1, 18, 35, 47, 52 | | C223 100n
IC 202 | | 1, 39, 40 | 2, 11, 20, 30 | | C224 100n
IC 203 | | 20 | 10 | | C232 100n
IC 204 | | 20 | 10 | | C233 100n
IC 205 | 26 | | 22 | | C226 10n
| | | 22 | 28 | C227 10n
IC 207 | | | 2, 6, 9, 11, 12, 13 | | |
IC 208 | | 14 | 7 | | C236 1µ0
IC 209 | | 17, 36, 53, 68 | 1, 18 35 47 52 | | C228 10n
IC 210 | | 20 | 10 | | C234 100n
IC 211 | | 20 | 10 | | C235 100n
IC 212 | 26 | | 22 | | C230 10n
| | | 22 | 28 | C231 10n
IC214 | | | 2, 6, 9, 11, 12, 13 | | |

AA1/2

Drg. No. Z 44829/800M Sht. 2 of 7, Iss. 1

(In general, this circuit diagram also applies to earlier versions of the board.)

Fig. 7-3 Control : Audio synthesizer circuit diagram

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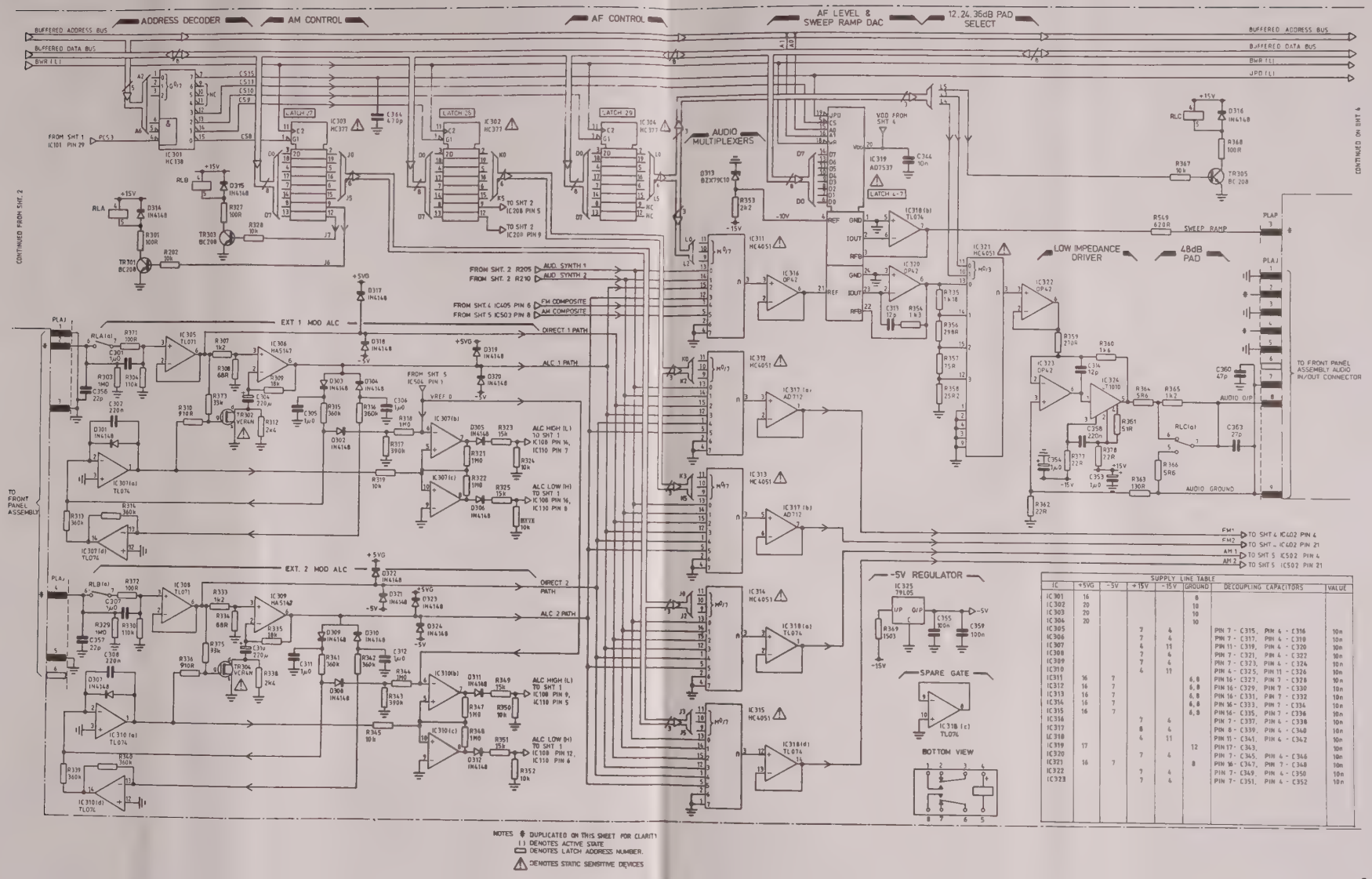

Drg No. Z 44829/800M Sht. 3 of 7, Iss. 2

(In general, this circuit diagram also applies to earlier versions of the board.)

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AA1/2

Fig. 7-4 Control : Ext. mod and audio output circuit diagram

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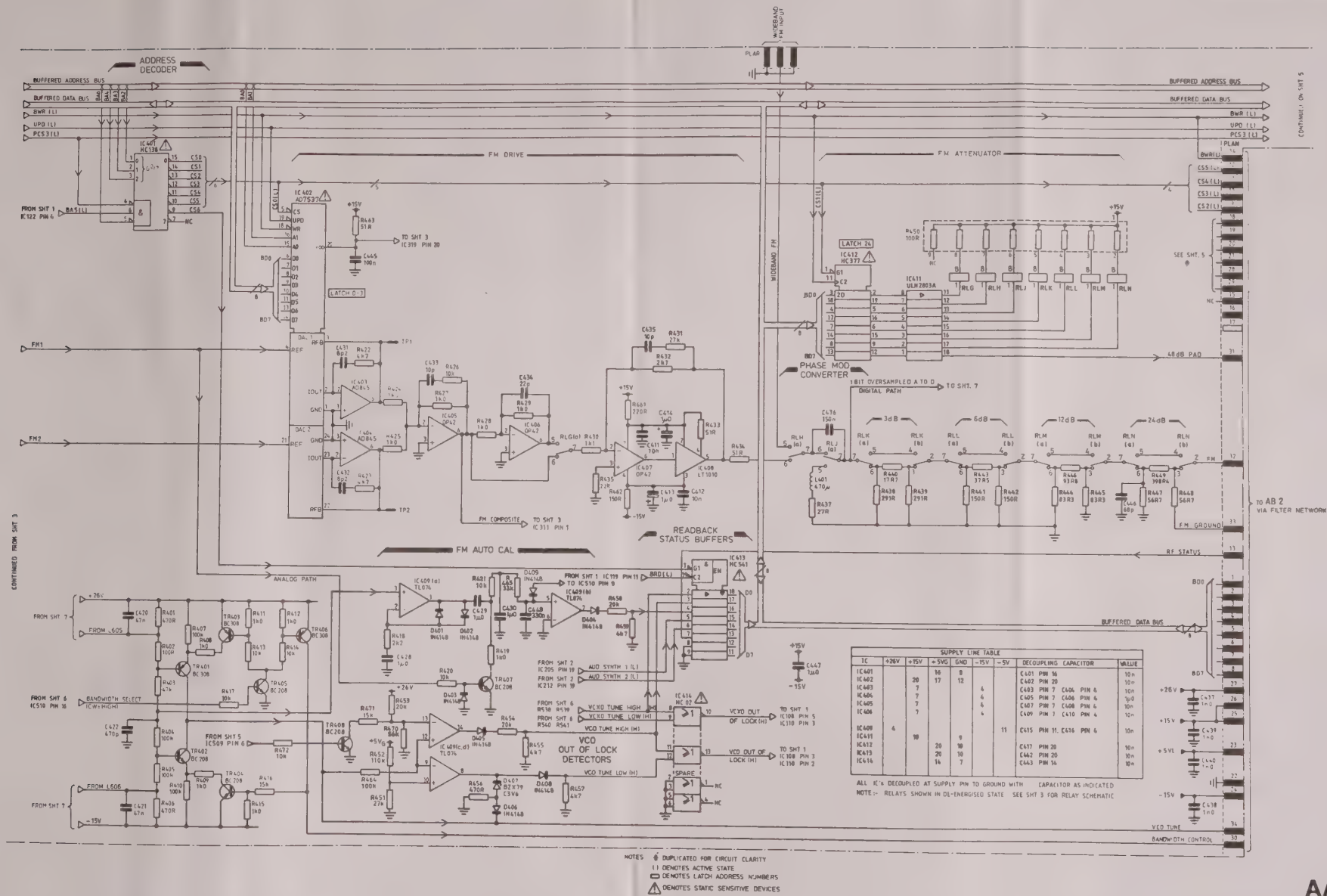

AA1/2

Fig. 7-5 Control : FM and ΦM drive circuit diagram

Drg. No. Z 44829/800M Sht. 4 of 7, Iss. 4

(In general, this circuit diagram also applies to earlier versions of the board.)

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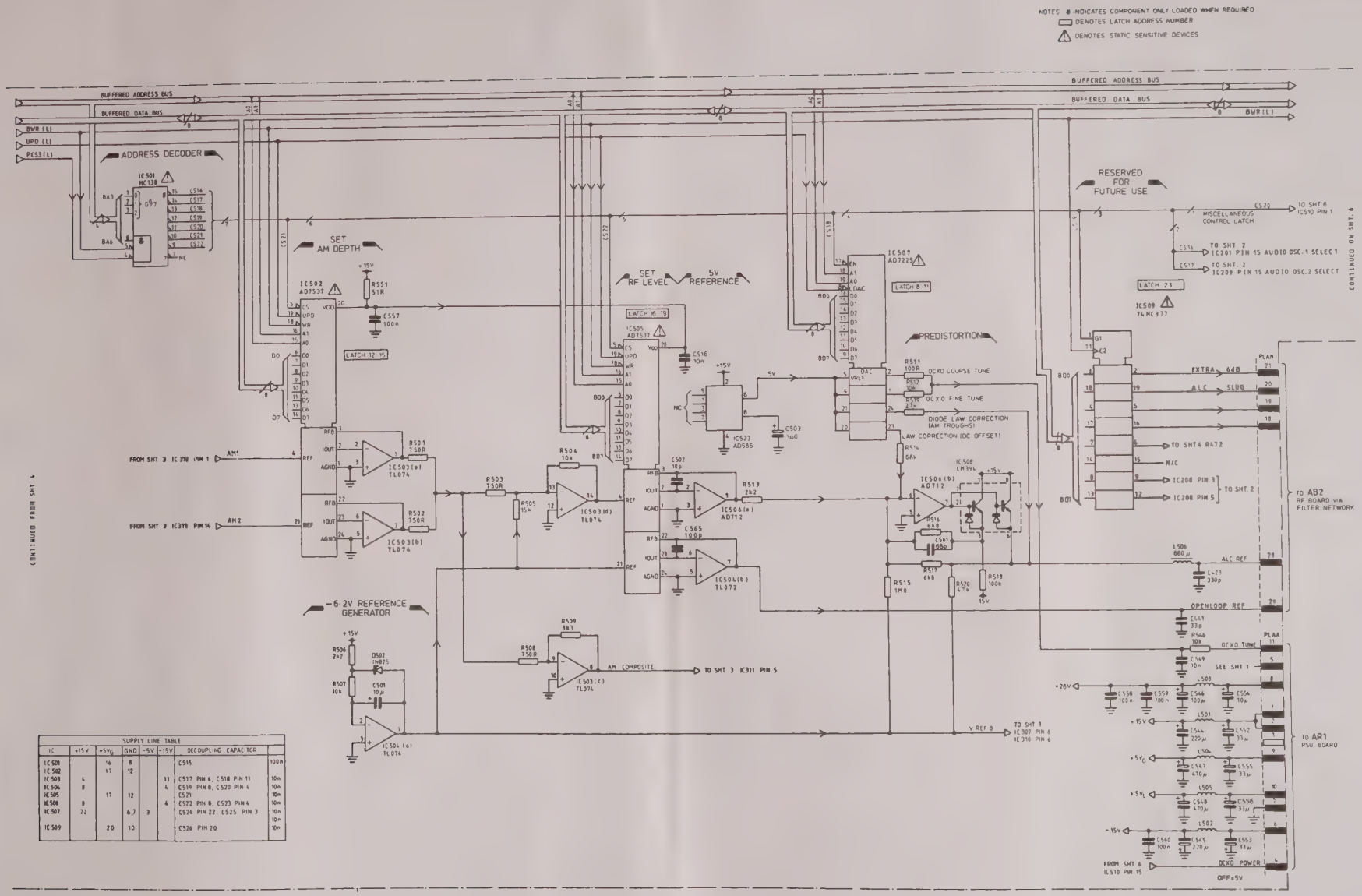

SUPPLY LINE TABLE

IC	+15V	+5V$_D$	GND	-5V	-15V	DECOUPLING CAPACITOR	
IC 501		16	8			C515	100n
IC 502		17	12				
IC 503	4				11	C517 PIN 4, C518 PIN 11	10n
IC 504	8				4	C519 PIN 8, C520 PIN 4	10n
IC 505		17	12			C521	10n
IC 506	8				4	C522 PIN 8, C523 PIN 4	10n
IC 507	22		6,7	3		C524 PIN 22, C525 PIN 3	10n
							10n
IC 509		20	10			C526 PIN 20	10n

AA1/2

Fig. 7-6 Control : AM and RF law correction circuit diagram

Drg. No. Z 44829/800M Sht 5 of 7, Iss. 1

(In general, this circuit diagram also applies to earlier versions of the board.)

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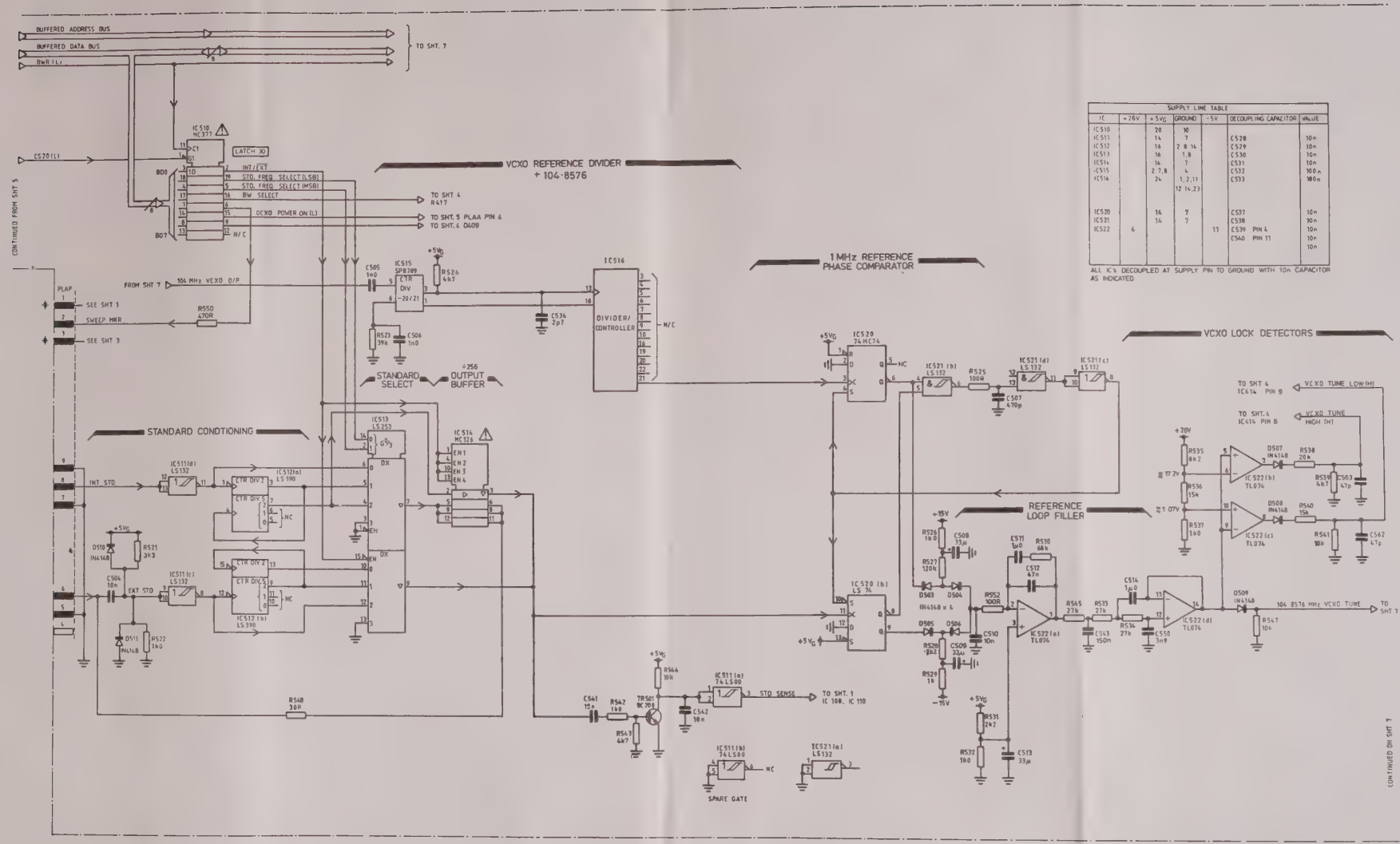

SUPPLY LINE TABLE

IC	+26V	+5V$_G$	GROUND	-5V	DECOUPLING CAPACITOR	VALUE
IC 510		20	10			
IC 511		14	7		C528	10n
IC 512		16	2 8 14		C529	10n
IC 513		16	1,8		C530	10n
IC 514		14	7		C531	10n
IC 515		2 7,8	4		C532	100n
IC 516		24	1, 2, 11 12 14, 23		C533	100n
IC 520		14	7		C537	10n
IC 521		14	7		C538	10n
IC 522	4			11	C539 PIN 4	10n
					C540 PIN 11	10n
						10n

ALL IC's DECOUPLED AT SUPPLY PIN TO GROUND WITH 10n CAPACITOR AS INDICATED

AA1/2

Fig. 7-7 Control : Reference PLL circuit diagram

Drg. No. Z 44829/800M Sht. 6 of 7, Iss. 3
(In general, this circuit diagram also applies to earlier versions of the board.)

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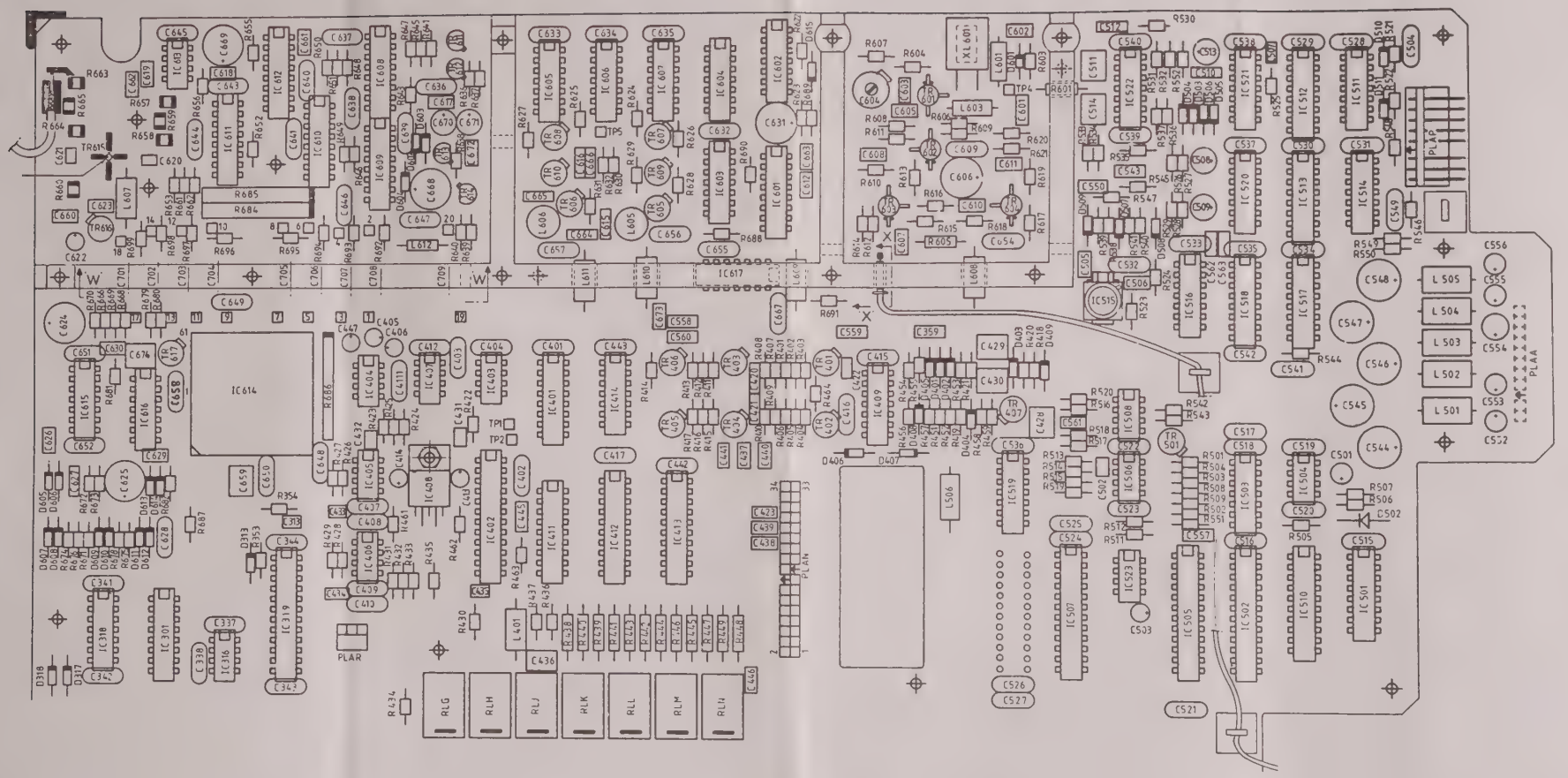
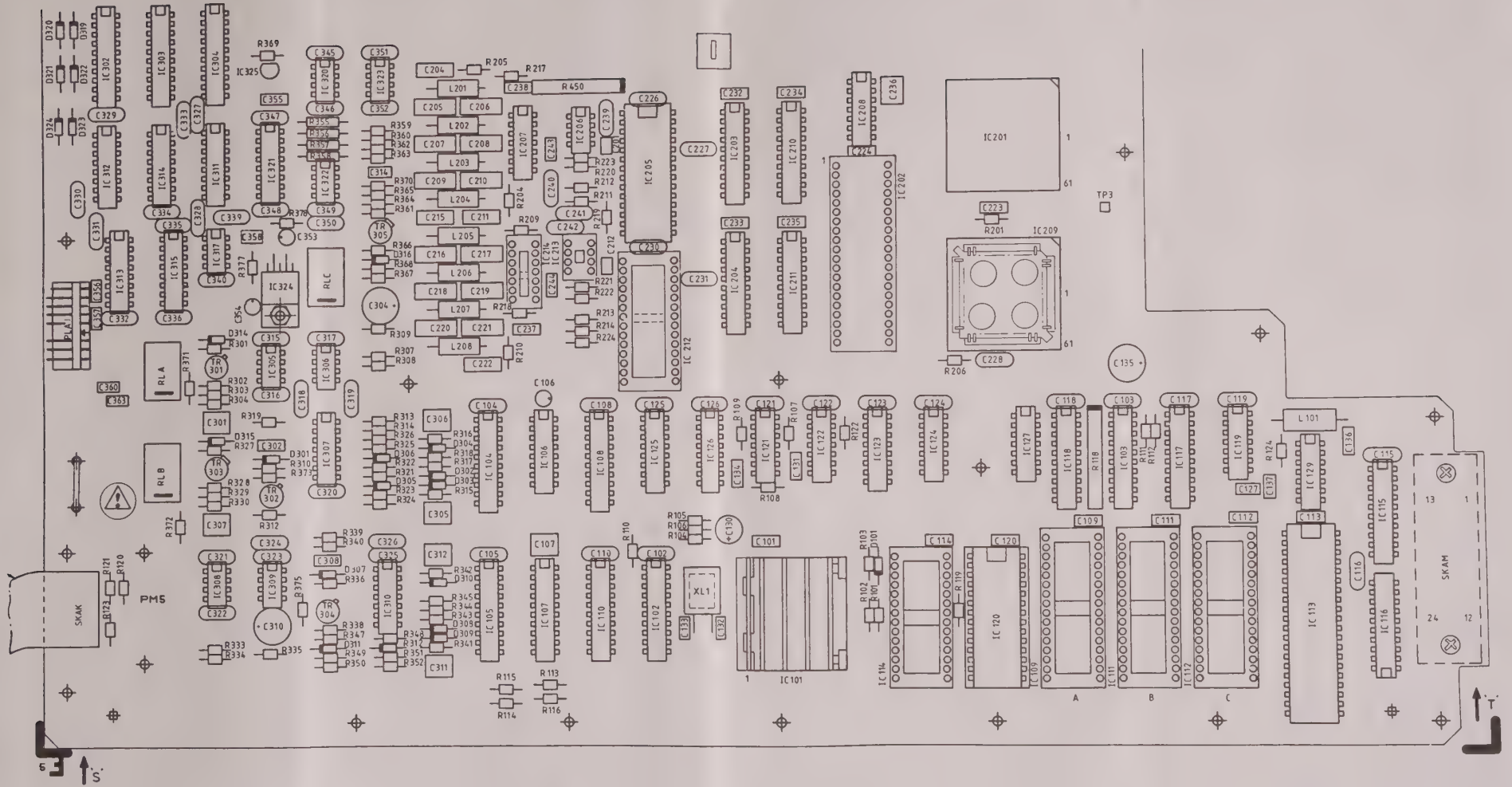


Fig. 7-8 Control board component layout


PM5
SKAM
RLA
RLB
RLC
IC324
IC325
IC201
IC202
IC209
IC205
IC212
IC101
XL1
TP3
SKAM
A
B
C

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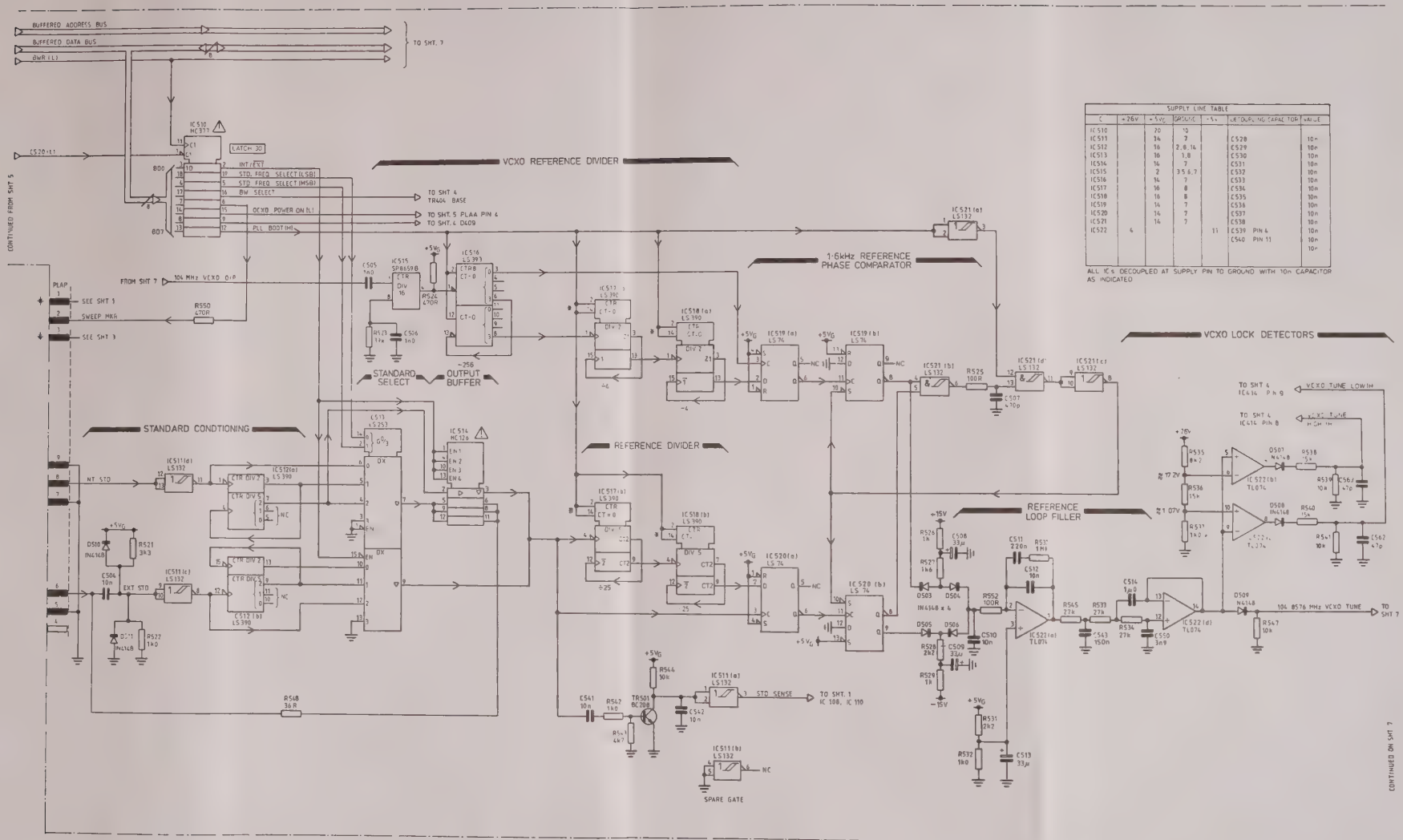

AA1

Fig. 7-8 Control : Reference PLL circuit diagram

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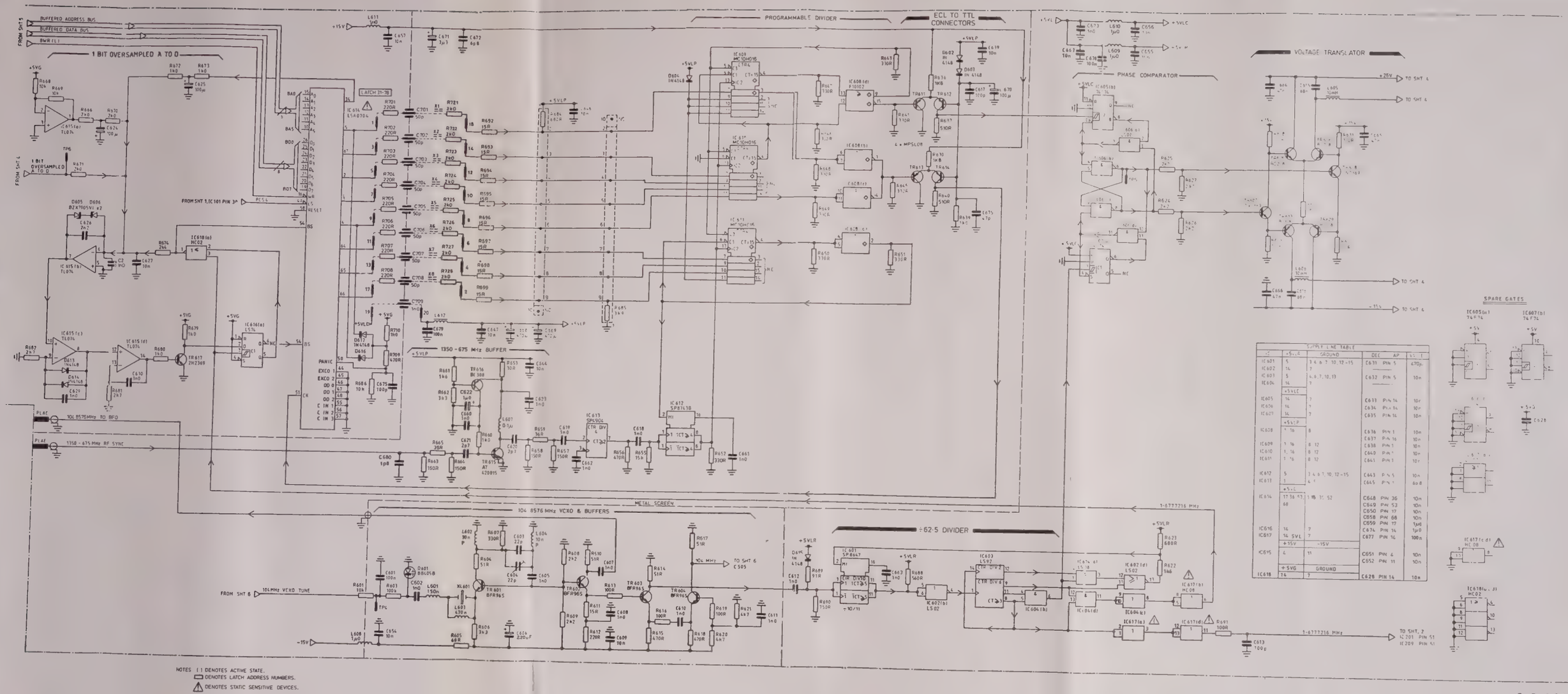

Drg. No. Z 44829/800M Sht 7 of 7, Iss. 4

(In general, this circuit diagram also applies to earlier versions of the board.)

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AA1/2

Fig. 7-9 Control : RF processing circuit diagram

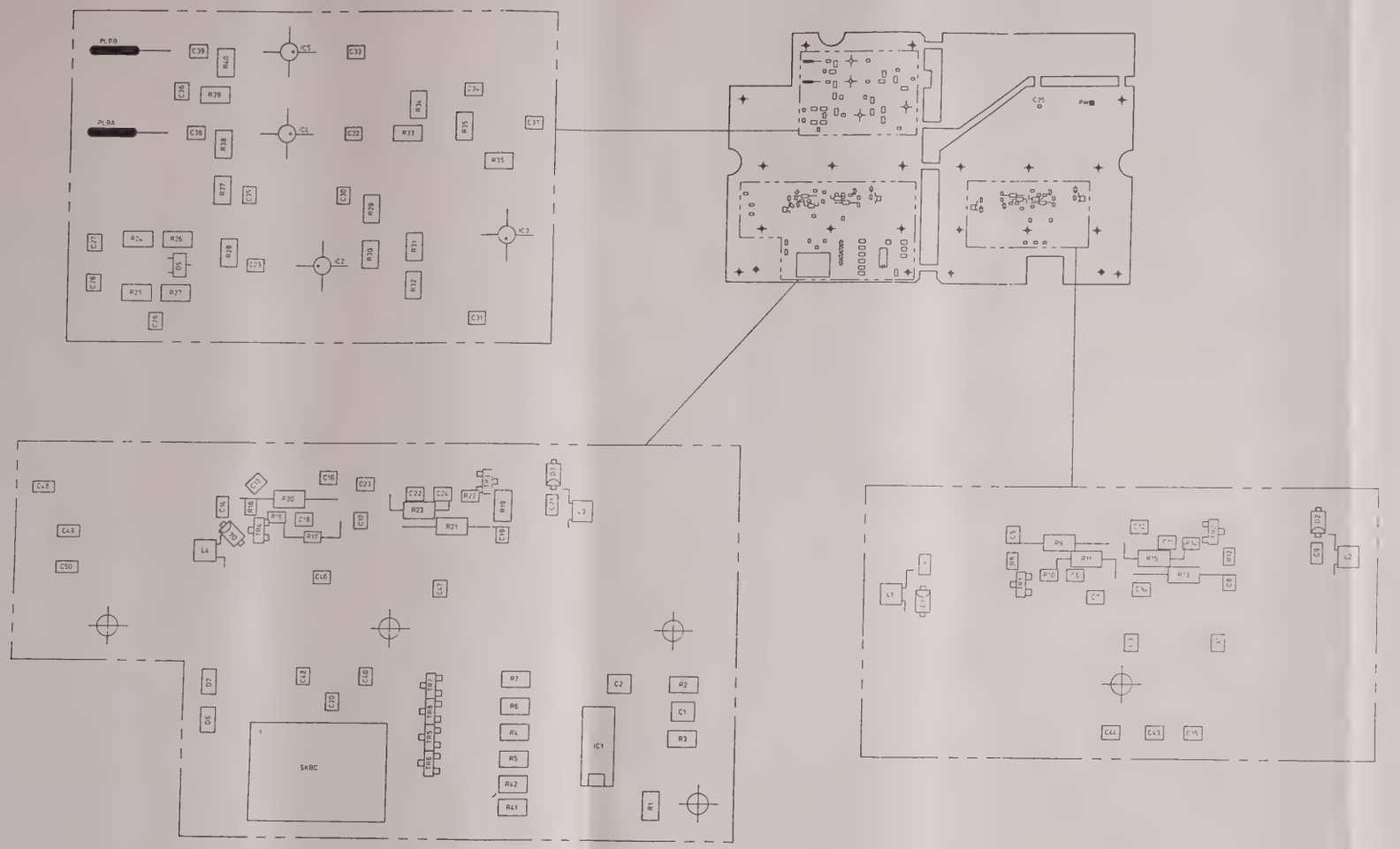
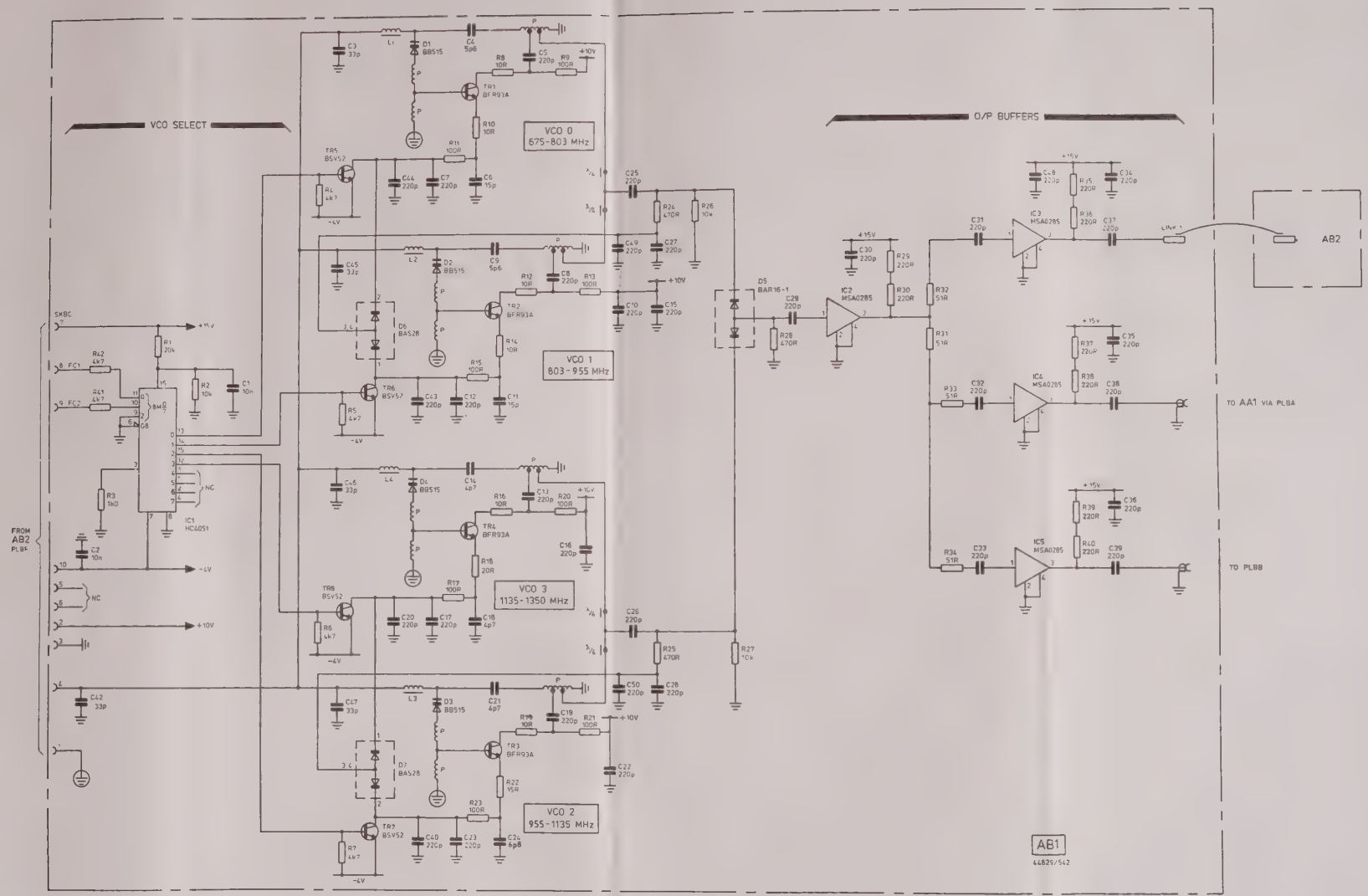


Fig. 7-10 VCO board component layout



AB1

Fig. 7-10 VCO board

Drg. No. Z 44829/542J, Sht. 1 of 1, Iss. 6

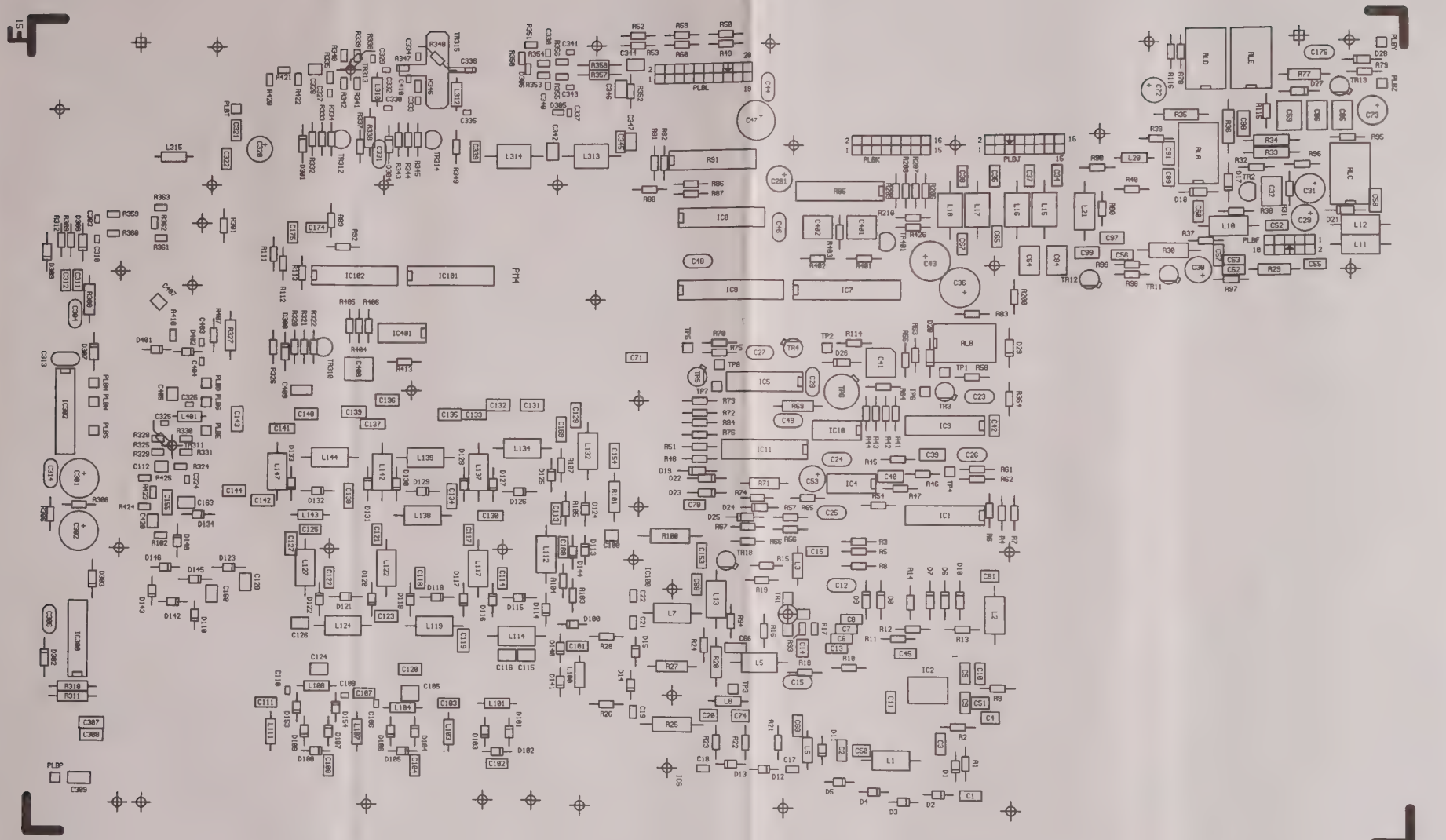
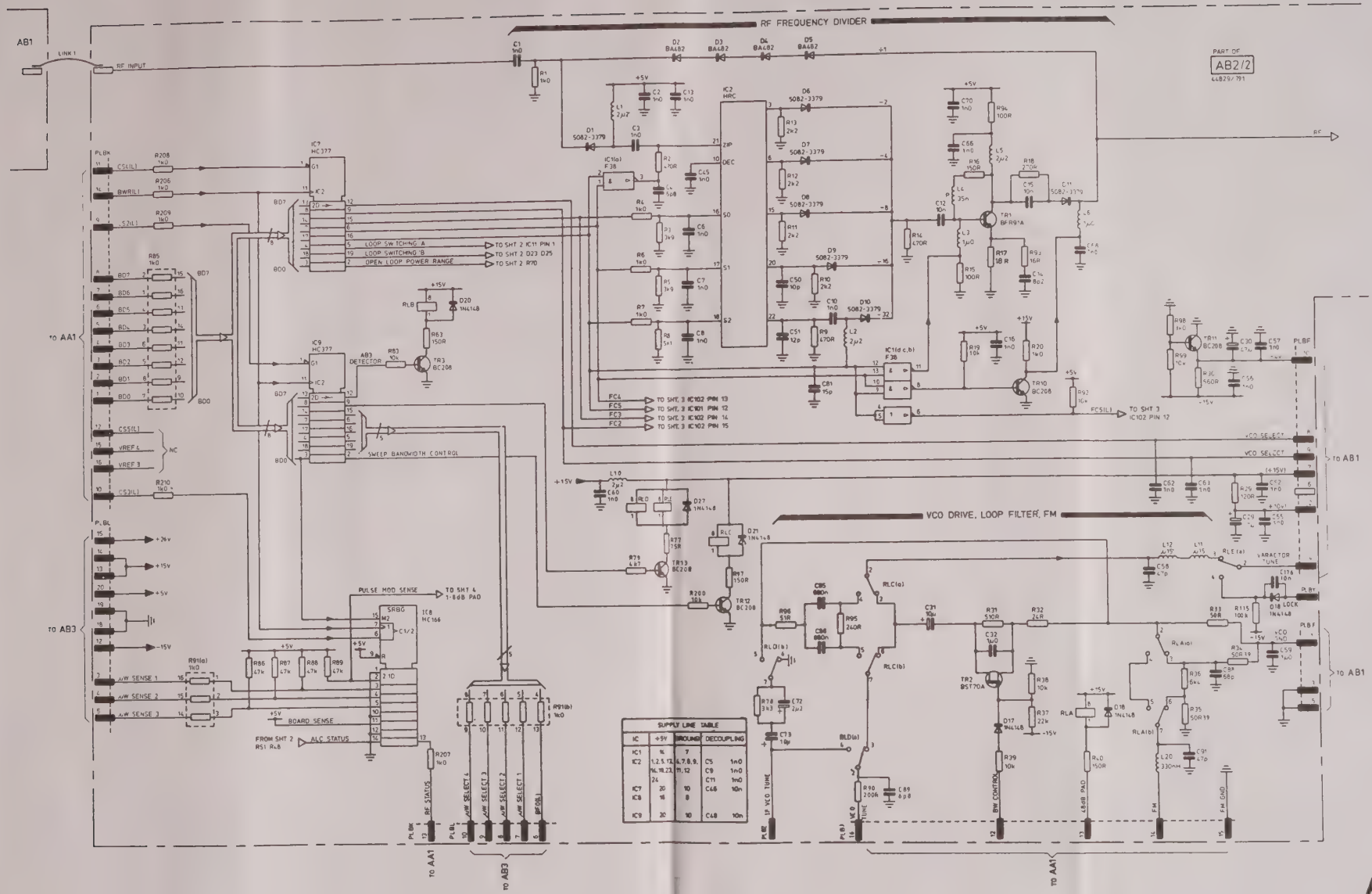


Fig. 7-11 RF board component layout



AB2/2

Fig. 7-11 RF board : Dividers and FM drive circuit diagram

Drg. No. Z 44829/791T Sht. 1 of 4, Iss. 3

(In general, this circuit diagram also applies to earlier versions of the board.)

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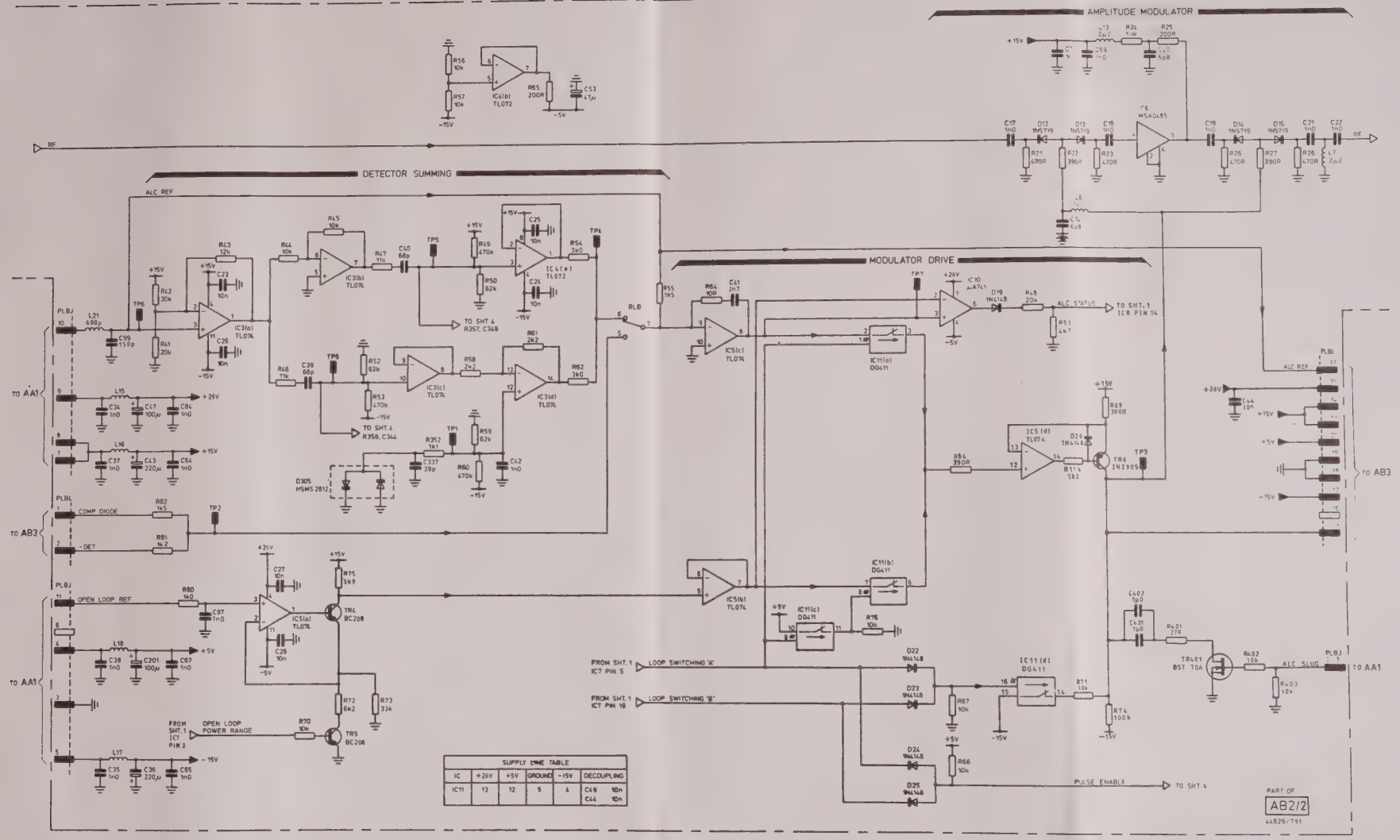

SUPPLY LINE TABLE					
IC	+26V	+5V	GROUND	-15V	DECOUPLING
IC11	13	12	5	4	C49 10n C44 10n

AB2/2

Fig. 7-12 RF board : Modulator and decoding circuit diagram

Drg. No. Z 44829/791T Sht. 2 of 4, Iss. 1
(In general, this circuit diagram also applies to earlier versions of the board.)

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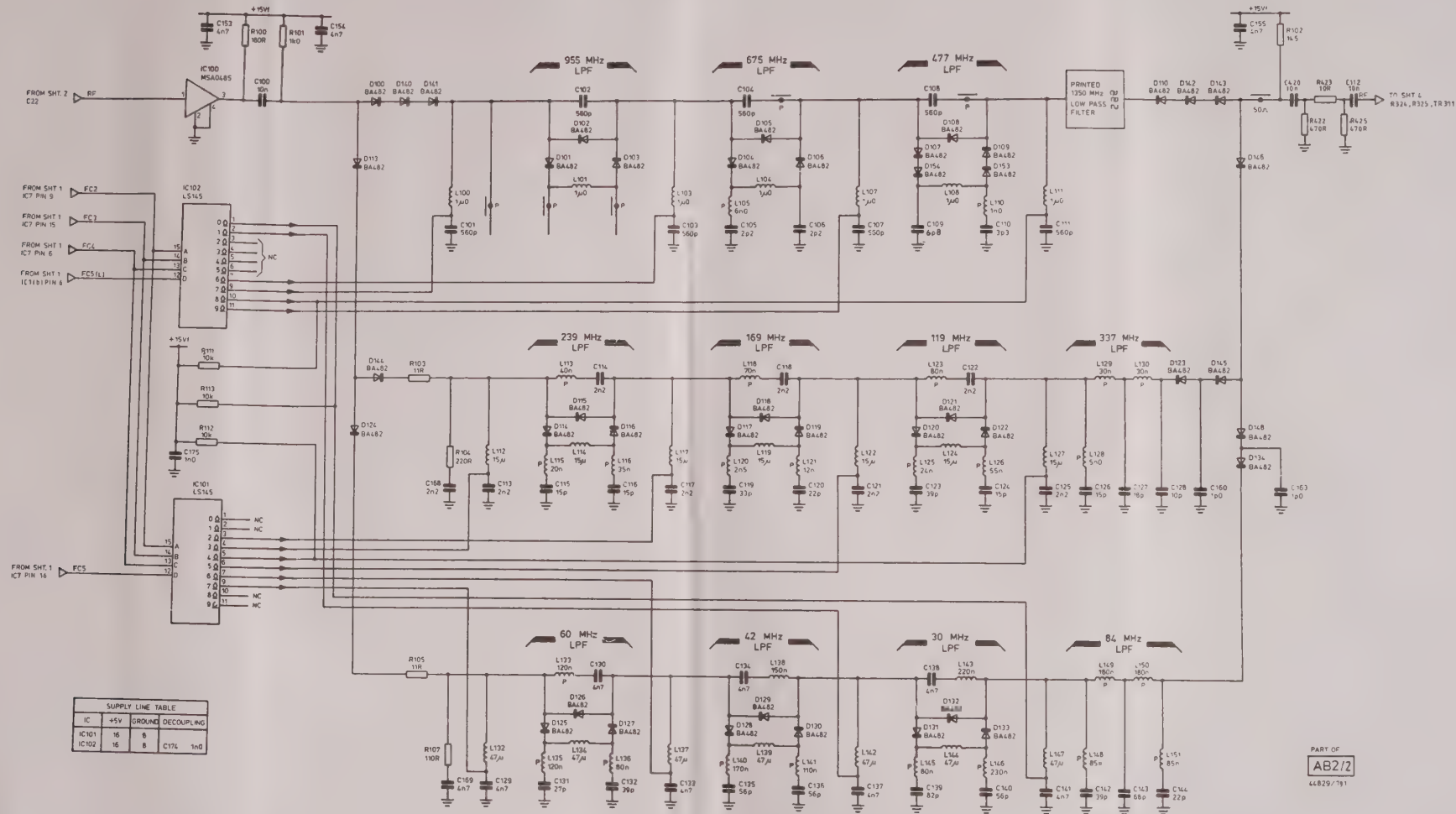

SUPPLY LINE TABLE			
IC	+5V	GROUND	DECOUPLING
IC101	16	8	C174 1n0
IC102	16	8	C174 1n0

Drg. No. Z 44829/791T Sht. 3 of 4, Iss. 2

(In general, this circuit diagram also applies to earlier versions of the board.)

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AB2/2

Fig. 7-13 RF board : Harmonic filters circuit diagram

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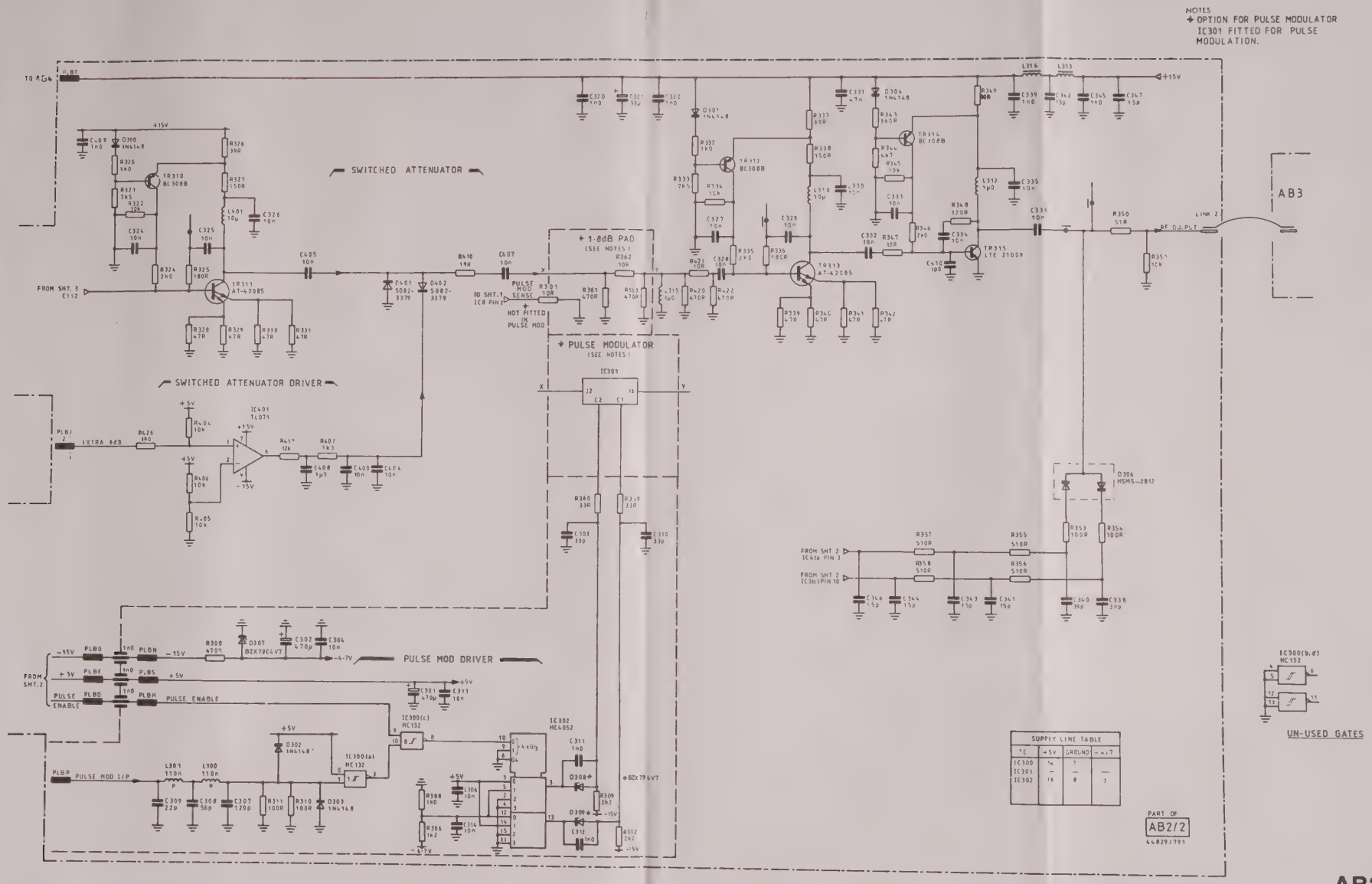


AB2/2

Drg. No. Z 44829/791T Sht. 4 of 4, Iss. 2
(In general, this circuit diagram also applies to earlier versions of the board.)

Fig. 7-14 RF board : Pulse mod and o/p amp circuit diagram

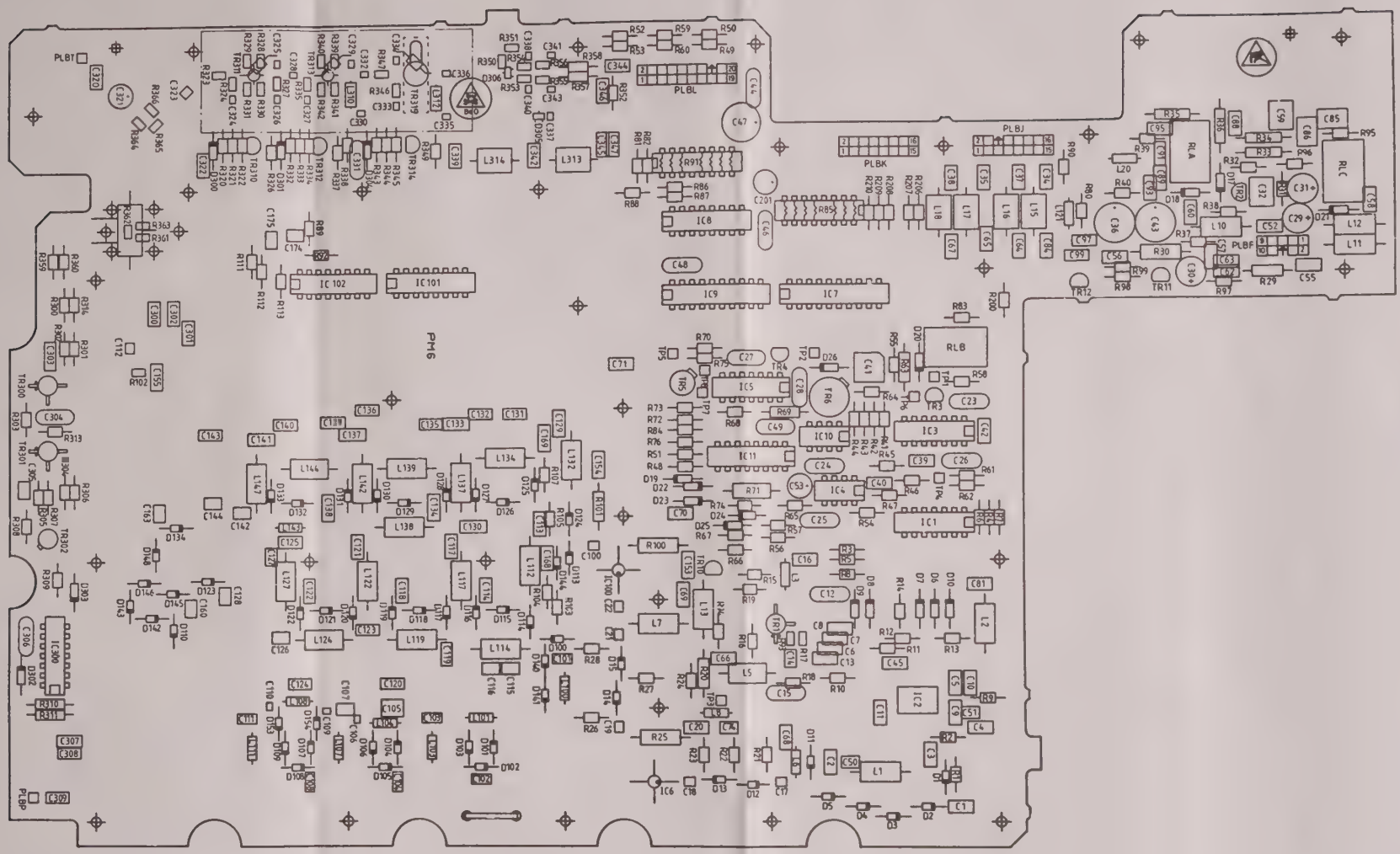
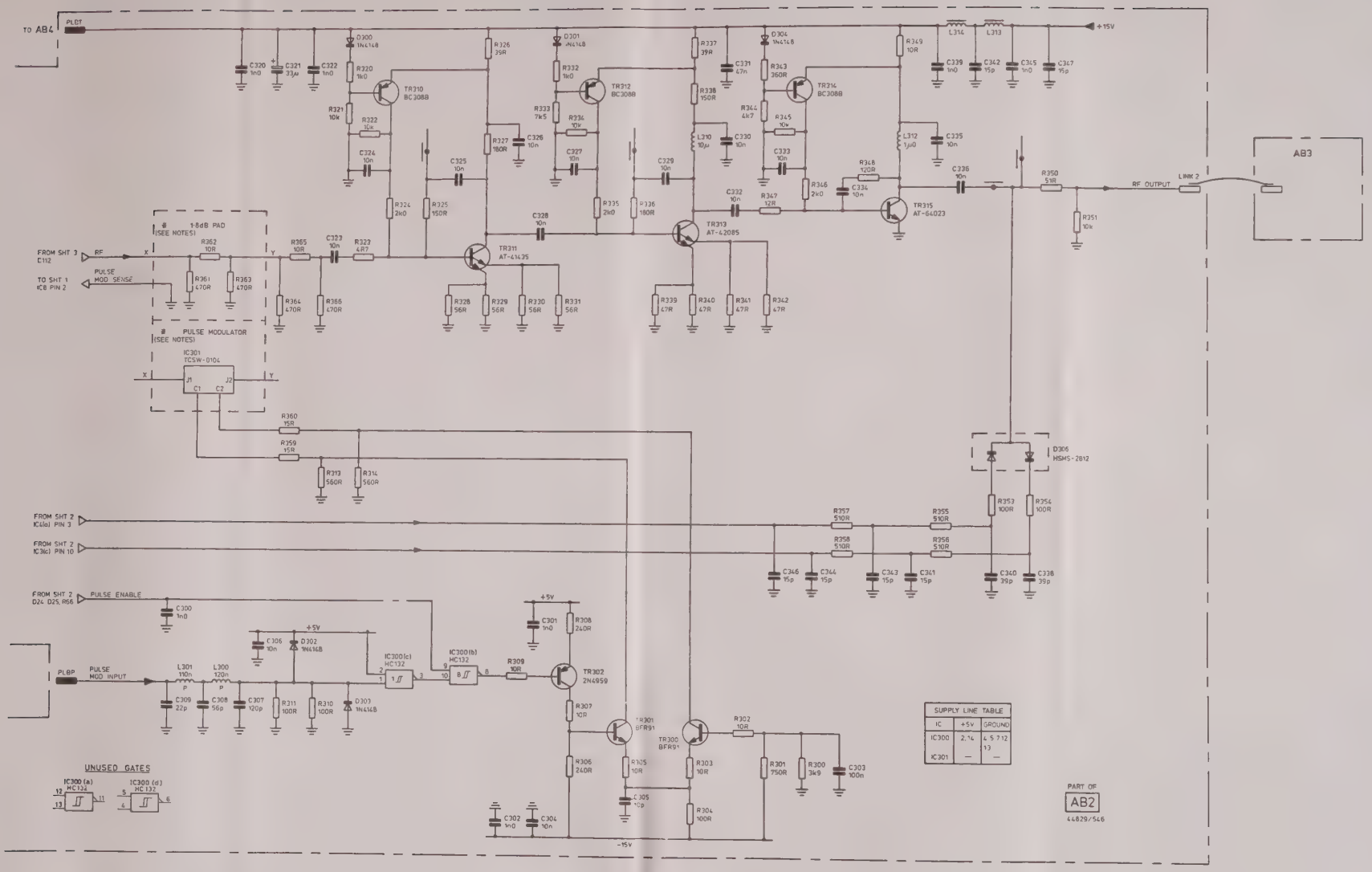


Fig. 7-15 RF board component layout



AB2

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Fig. 7-15 RF board : Pulse mod and o/p amp circuit diagram

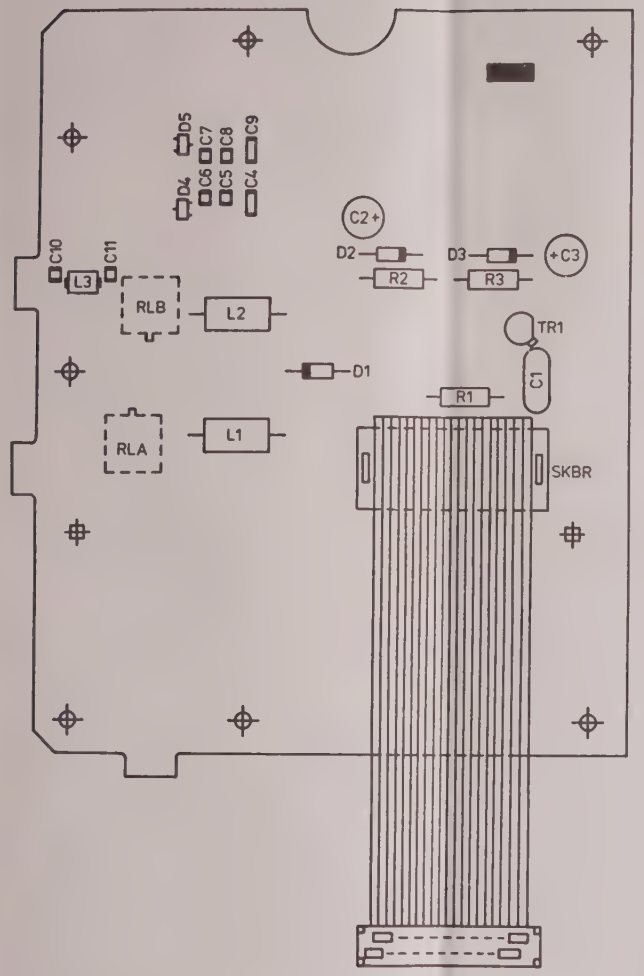
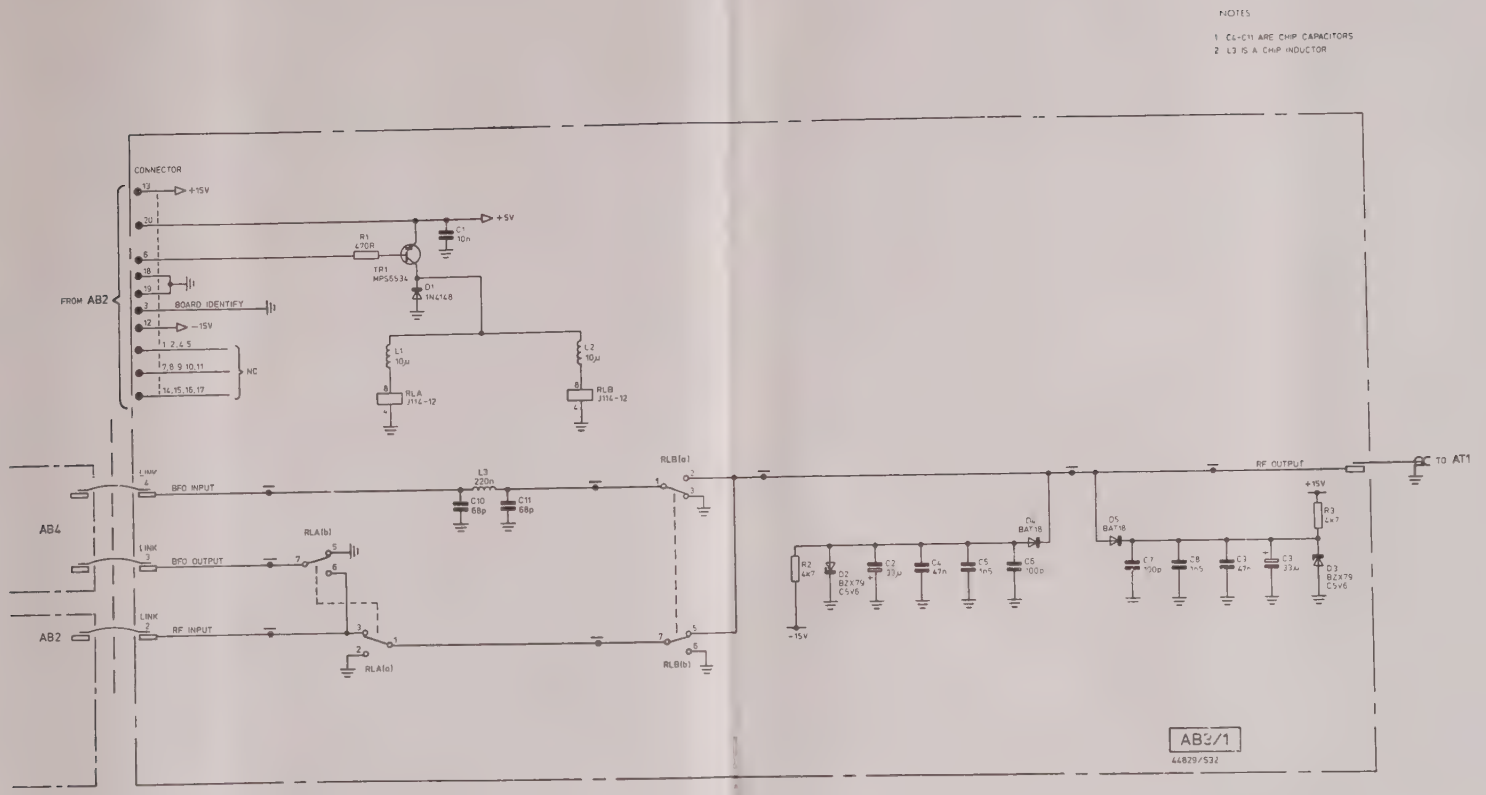


Fig. 7-16 BFO switch and RPP component layout



AB3/1

Fig. 7-16 BFO switch and RPP circuit diagram

Drg. No. Z 44829/532Z Sht. 1 of 1, Iss. 2

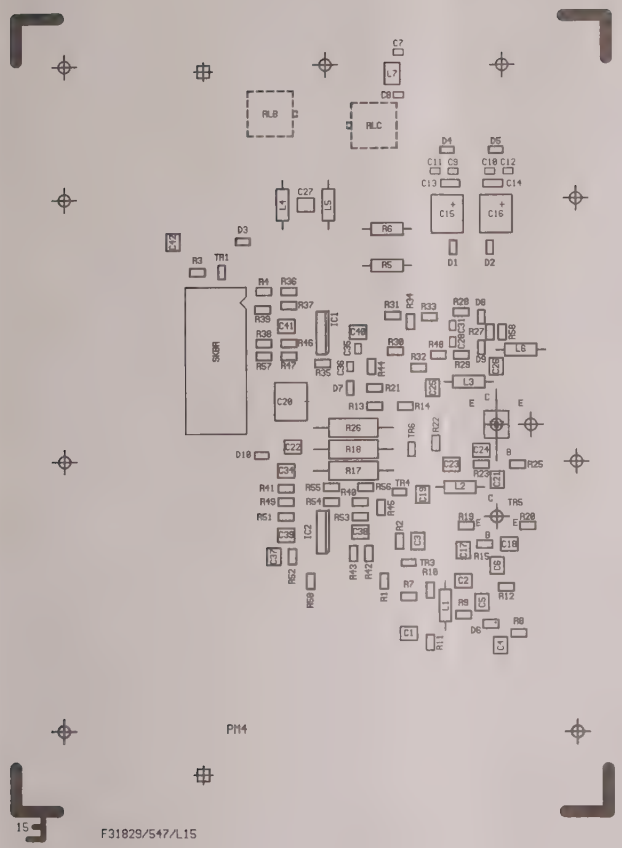
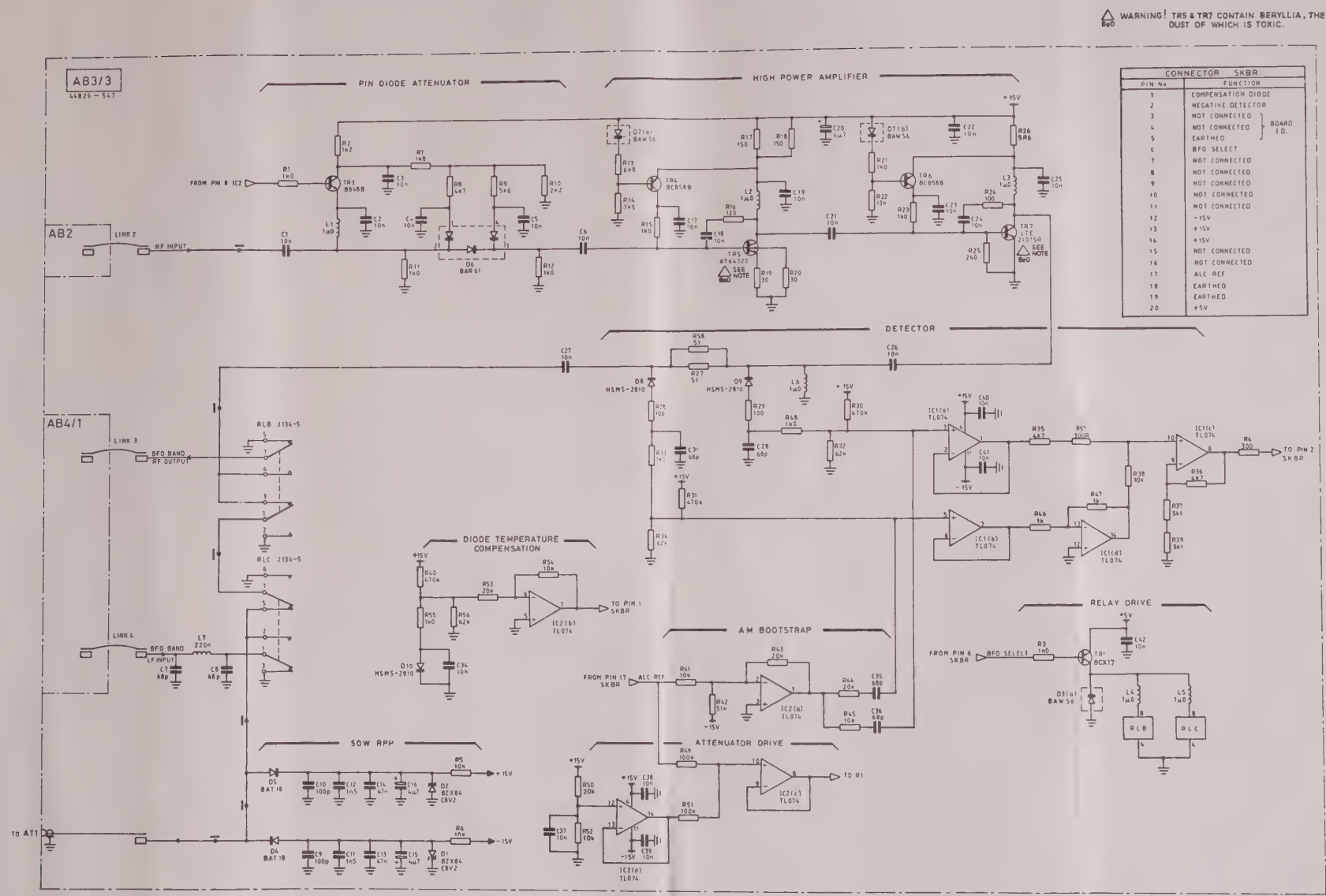


Fig. 7-17 High power amplifier component layout



AB3/3

Fig. 7-17 High power amplifier circuit diagram

Drg. No. Z 44829/547W Sht. 1 of 1, Iss. 3

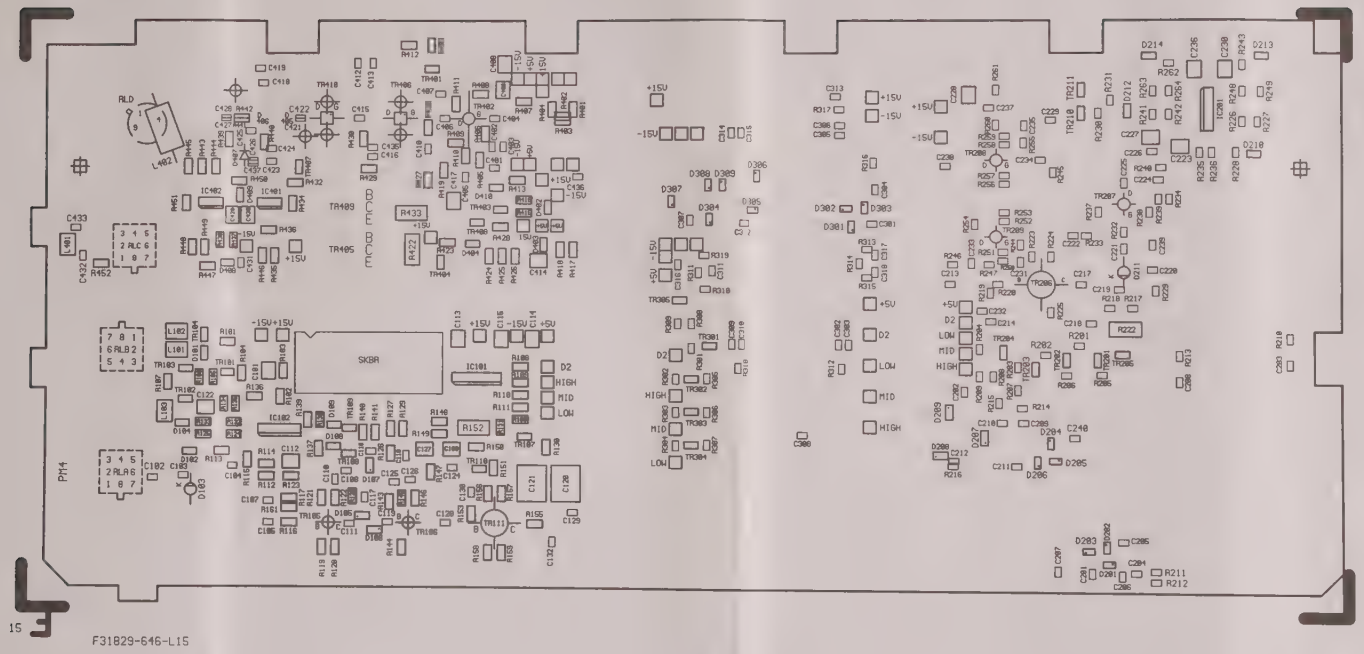
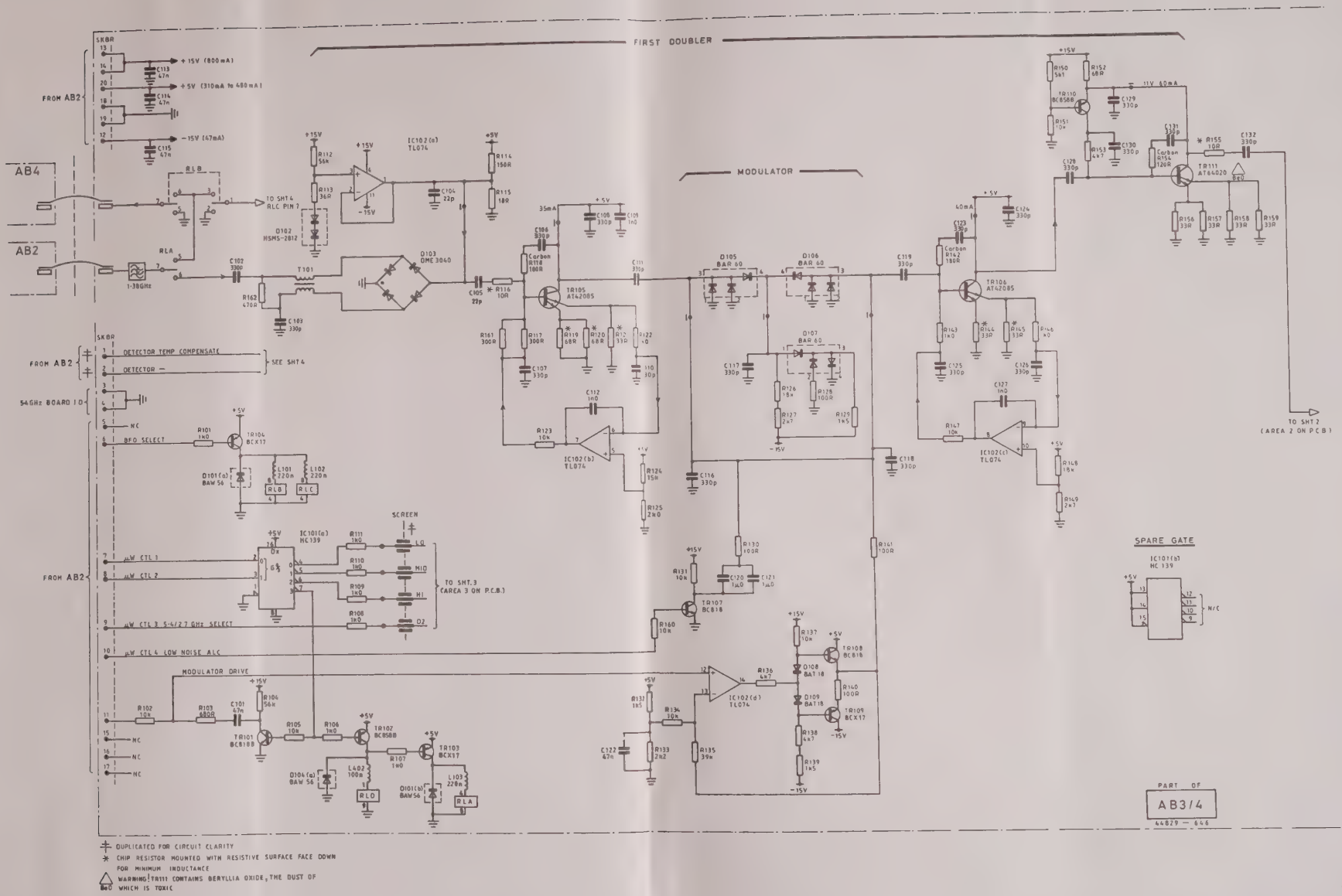


Fig. 7-18 Quadrupler component layout



AB3/4

Drg. No. Z 44829/646G Sht. 1 of 4, Iss. 6

Fig. 7-18 Quadrupler : First doubler & modulator circuit diagram

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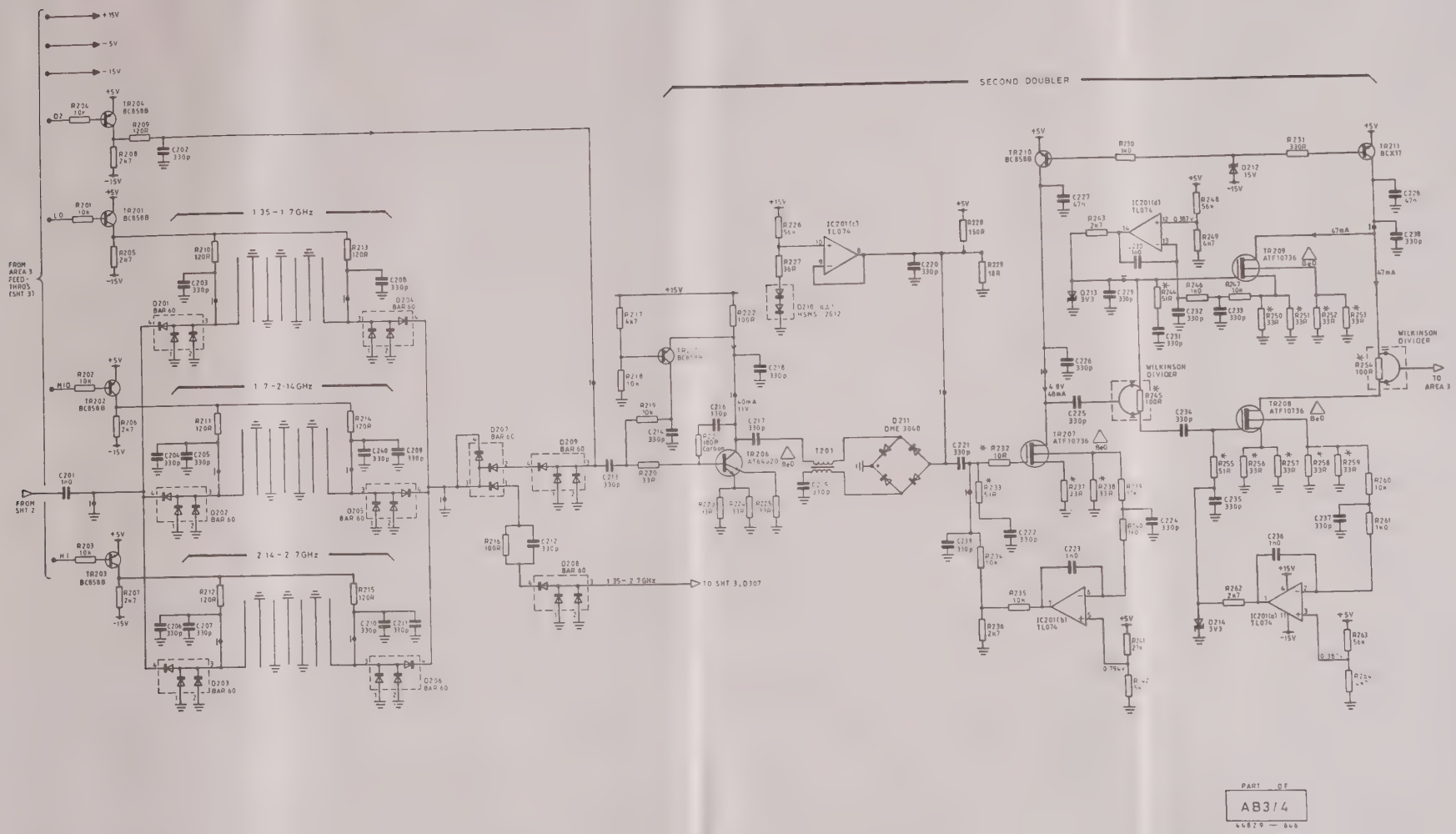

* CHIP RESISTOR MOUNTED WITH RESISTIVE SURFACE FACE DOWN FOR MINIMUM INDUCTANCE

△ WARNING! TR206 TO 209 CONTAIN BERYLLIA OXIDE, THE DUST OF WHICH IS TOXIC
Be0

AB3/4

Drg. No. Z 44829/646G Sht. 2 of 4, Iss. 3

Fig. 7-19 Quadrupler : BPF & second doubler circuit diagram

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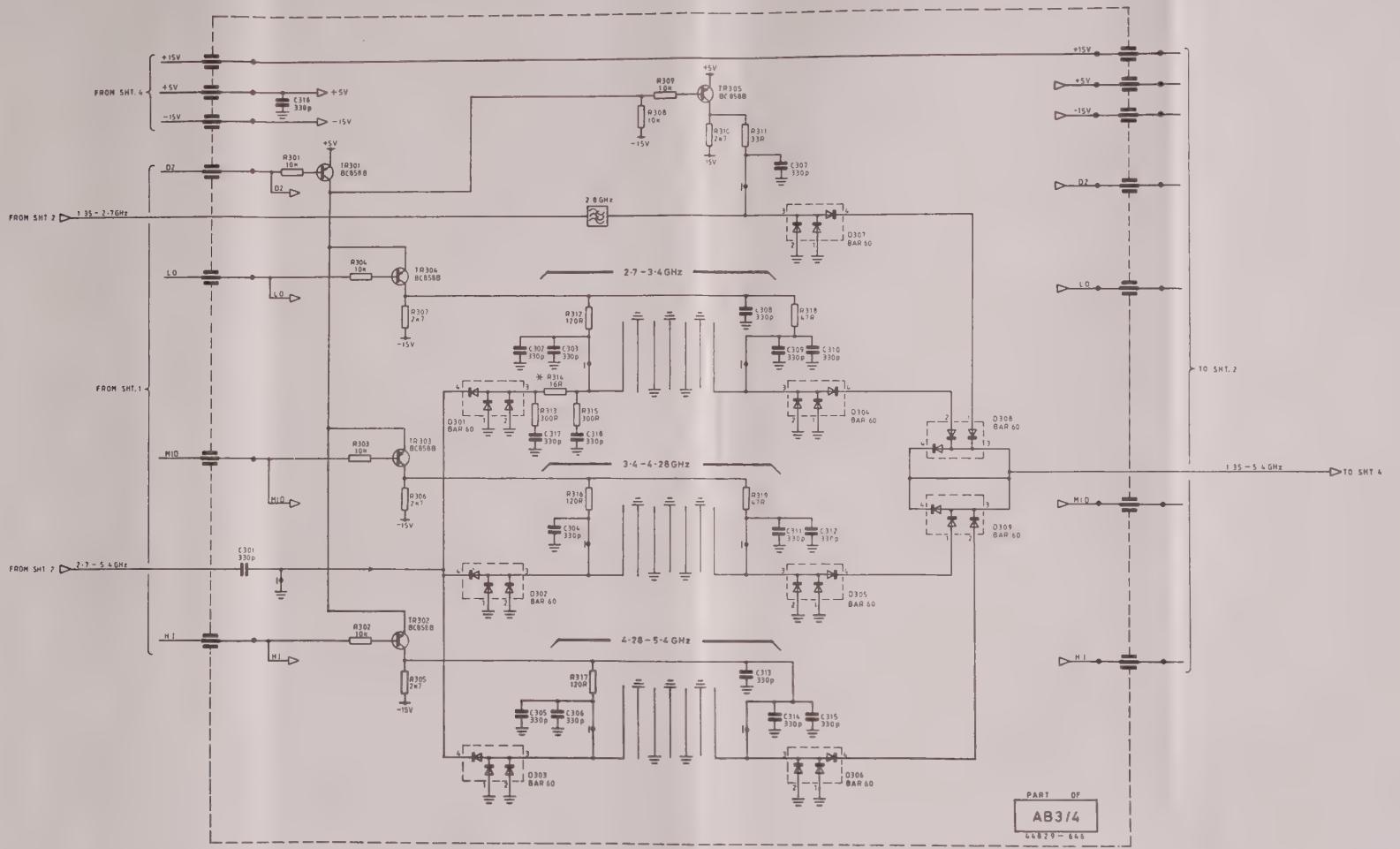

* CHIP RESISTOR MOUNTED WITH RESISTIVE SURFACE FACE DOWN FOR MINIMUM INDUCTANCE

AB3/4

Fig. 7-20 Quadrupler : Band-pass filters circuit diagram

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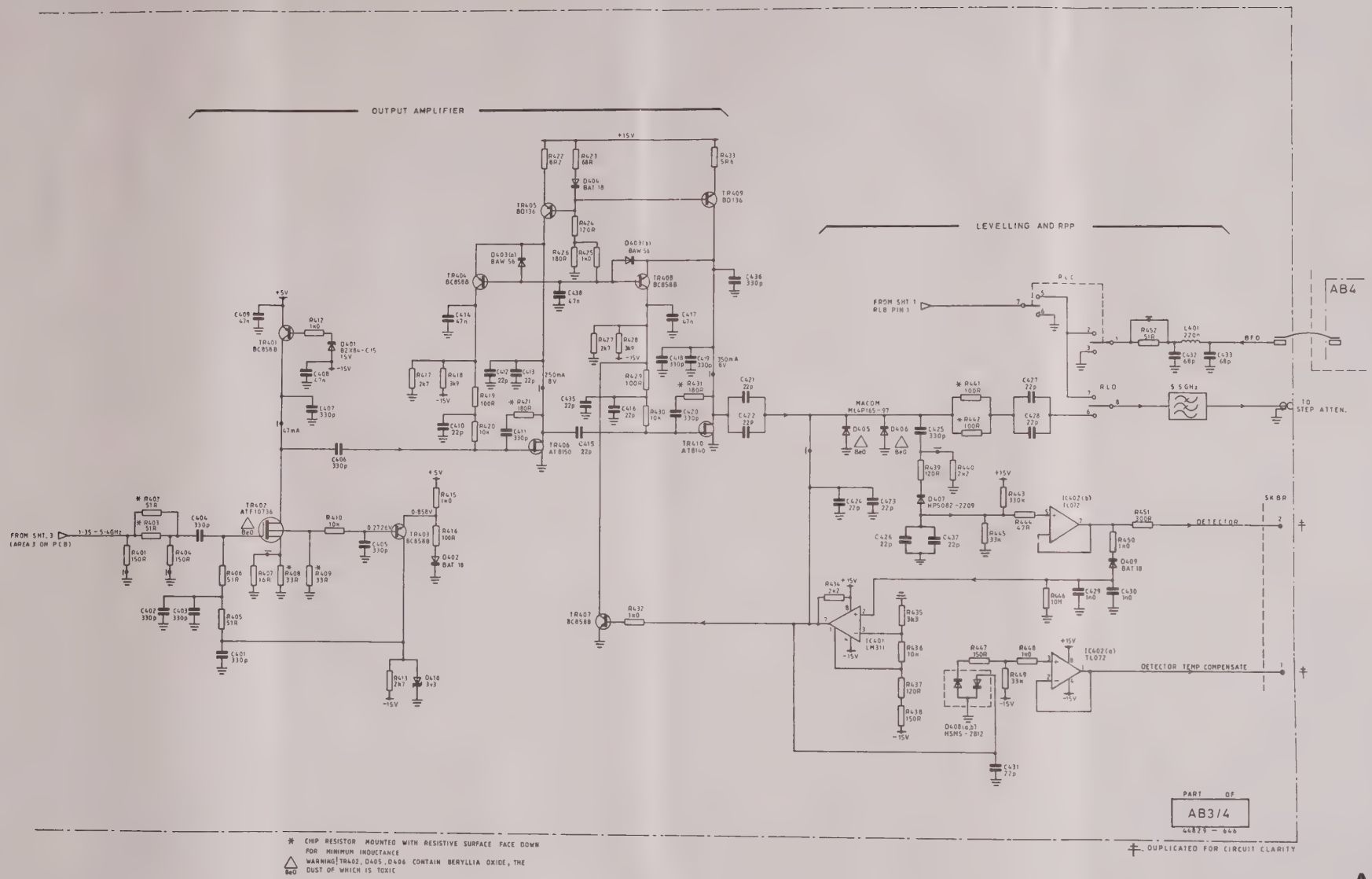
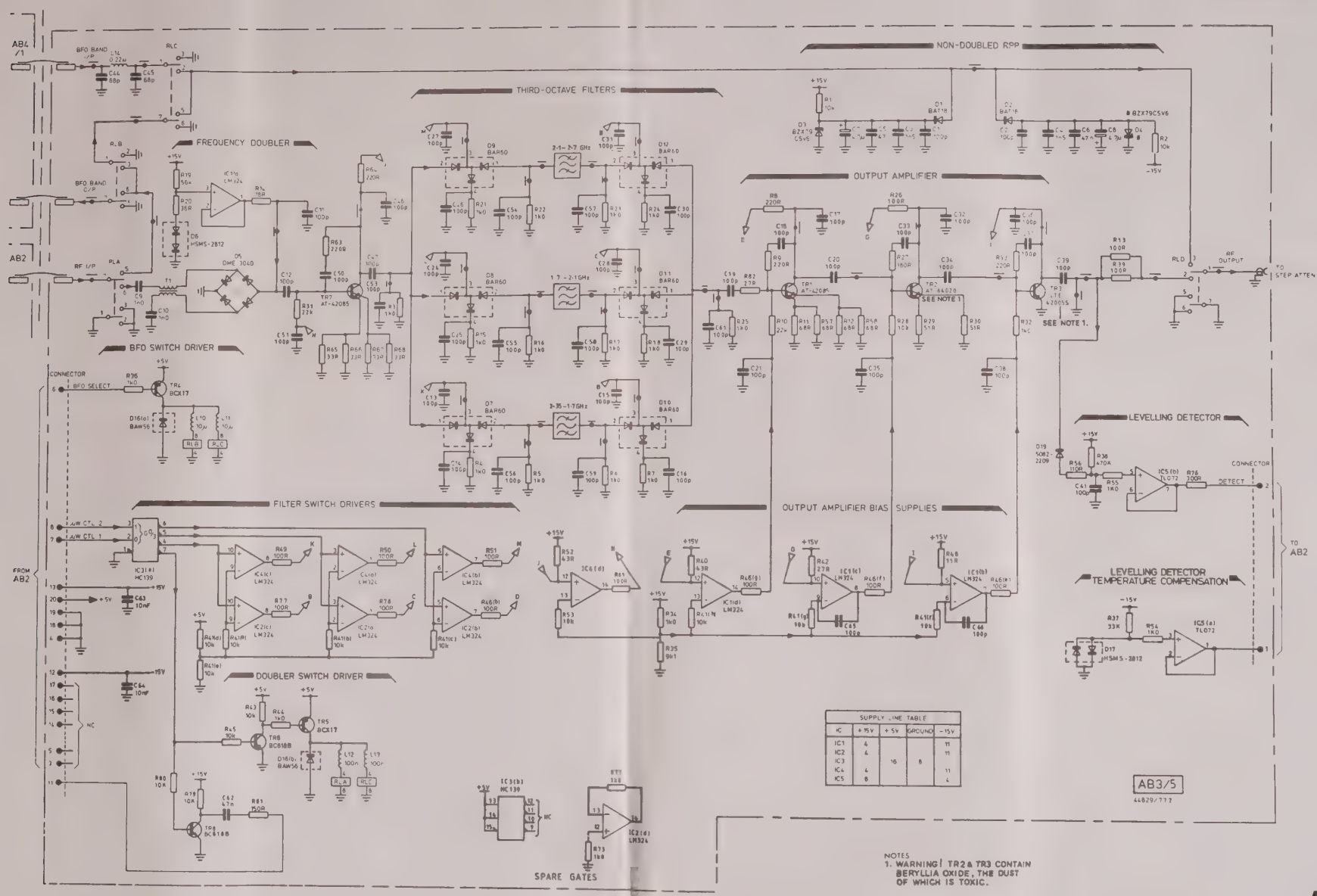


AB3/4

Drg. No. Z 44829/646G Sht. 4 of 4, Iss. 4

Fig. 7-21 Quadrupler : Output amp, levelling & RPP circuit diagram

Fig. 7-22 Frequency doubler component layout

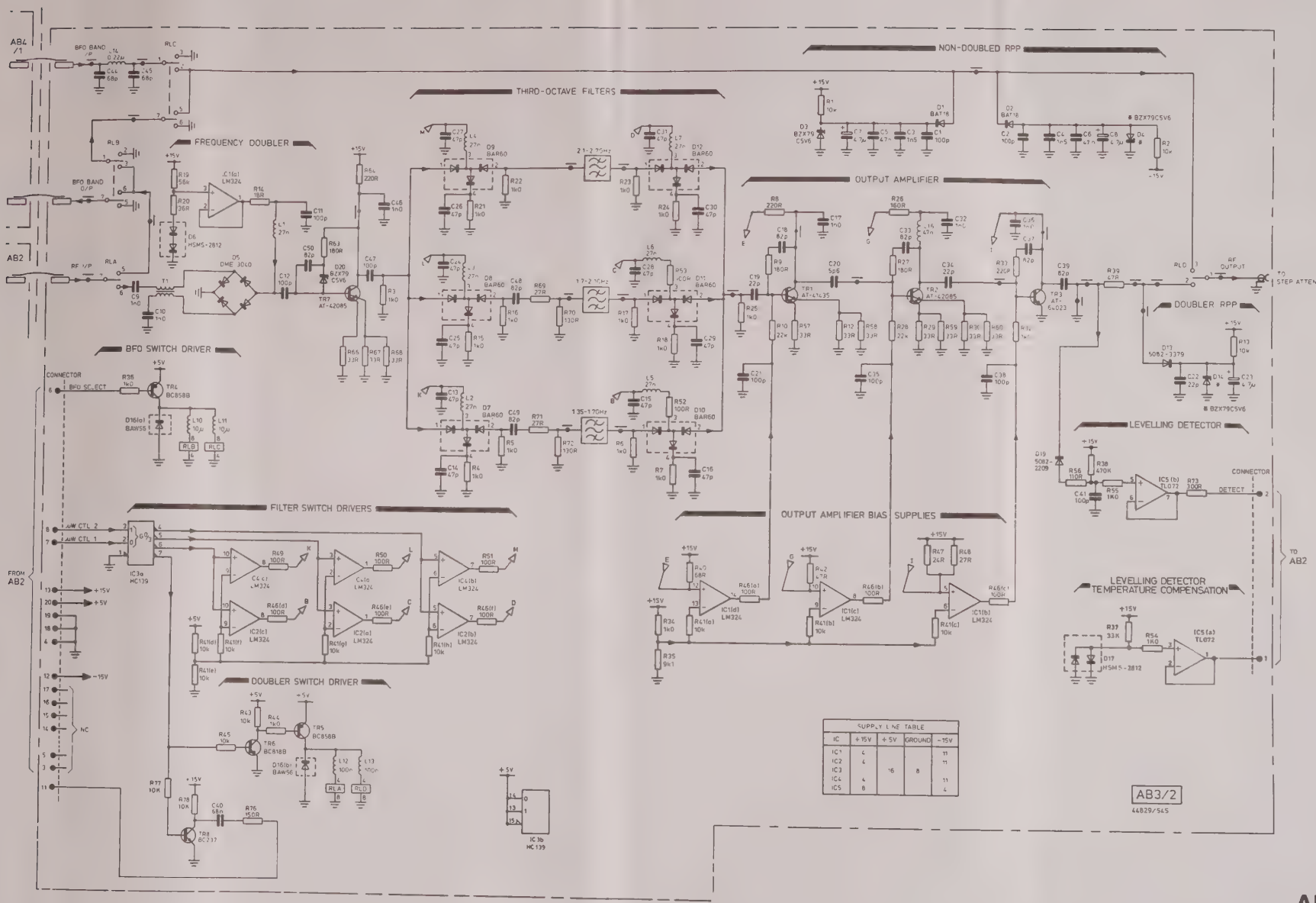


Drg. No. Z 44829/772H Sht. 1 of 1, Iss. 6

AB3/5

Fig. 7-22 Frequency doubler circuit diagram

Fig. 7-23 Frequency doubler component layout



Drg. No. Z 44829/545V Sht. 1 of 1, Iss. 6

AB3/2

Fig. 7-23 Frequency doubler circuit diagram

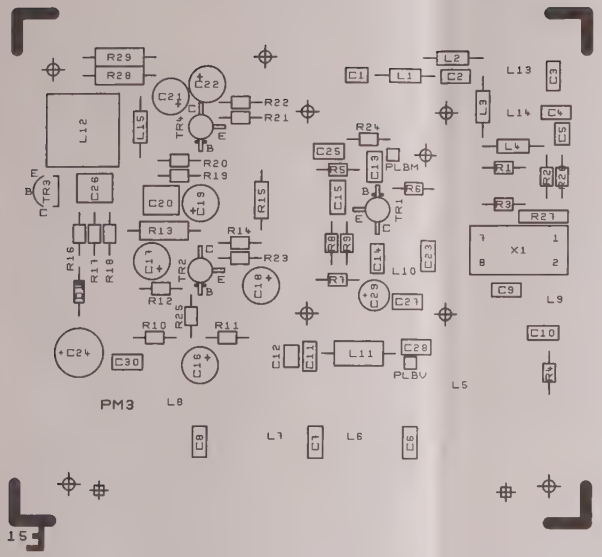
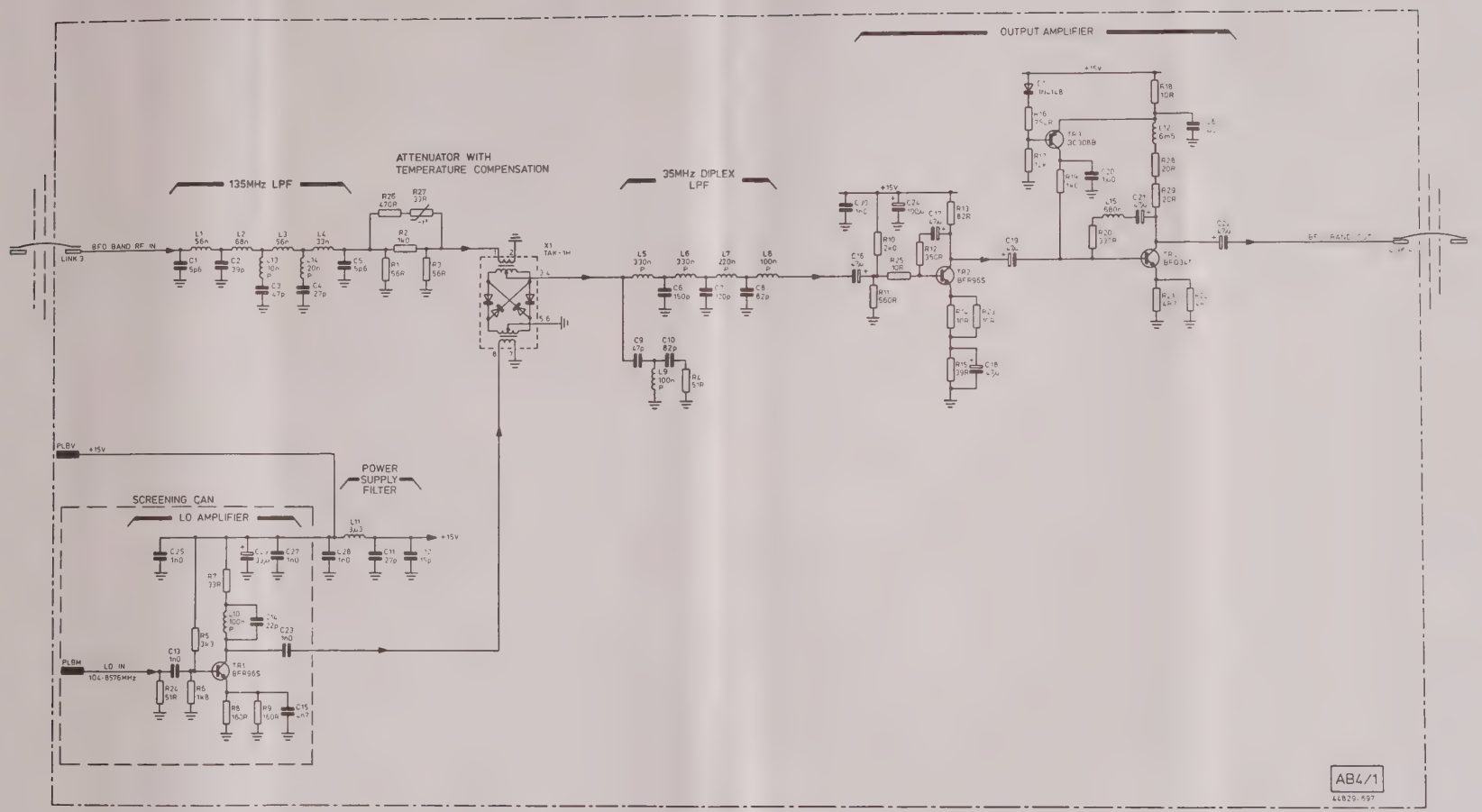


Fig. 7-24 Beat frequency oscillator component layout



AB4/1

Fig. 7-24 Beat frequency oscillator circuit diagram

Drg. No. Z 44829/697A Sht. 1 of 1, Iss. 1

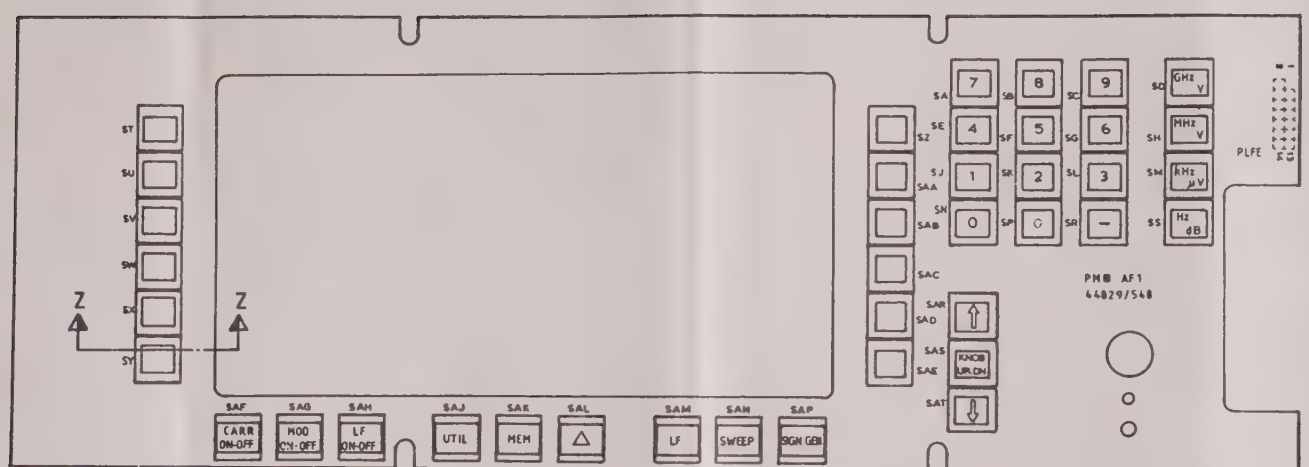
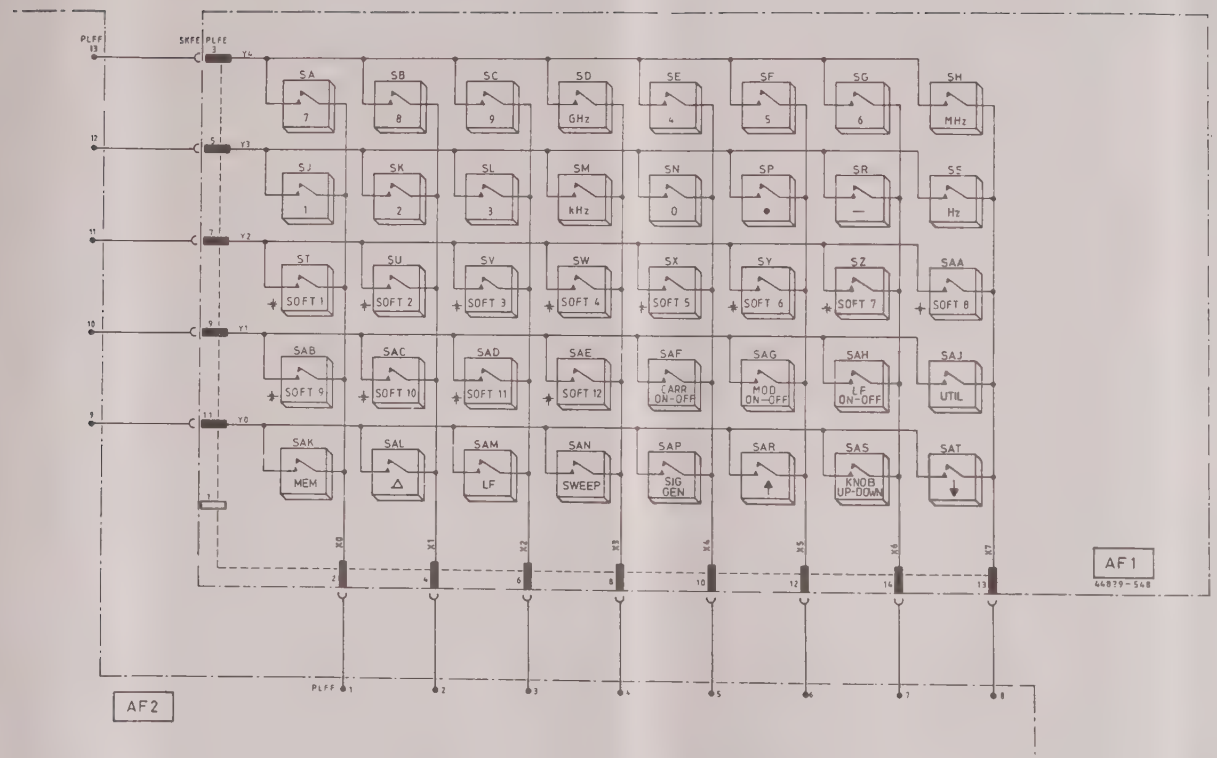


Fig. 7-25 Key matrix component layout

NOTE.
+ IDENTIFIED FOR CIRCUIT CLARITY ONLY.
KEYS LEFT BLANK.



Drg. No. Z 44829/548D Sht. 1 of 1, Iss. 2

AF1

Fig. 7-25 Key matrix circuit diagram

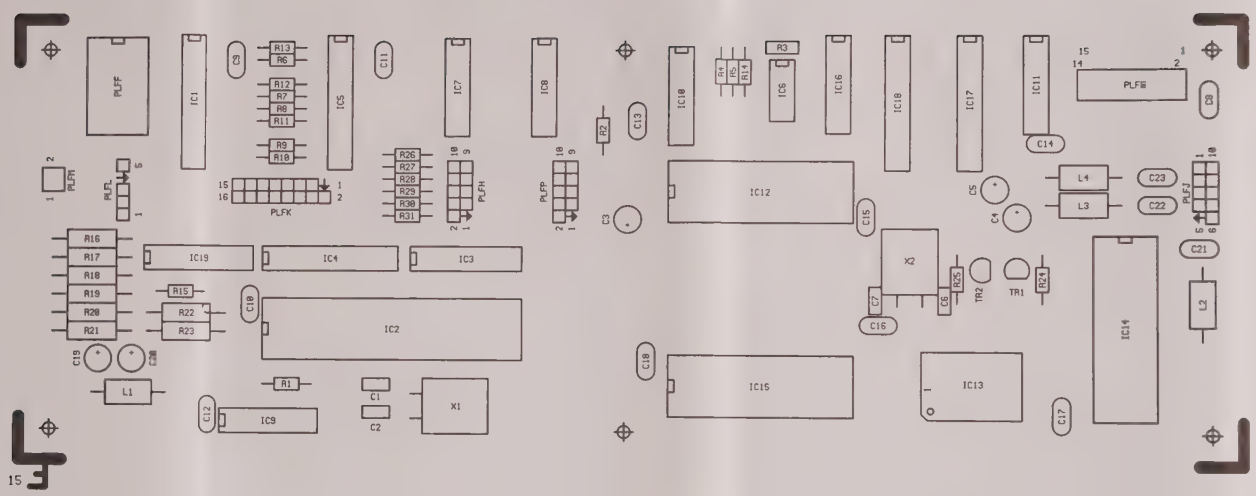
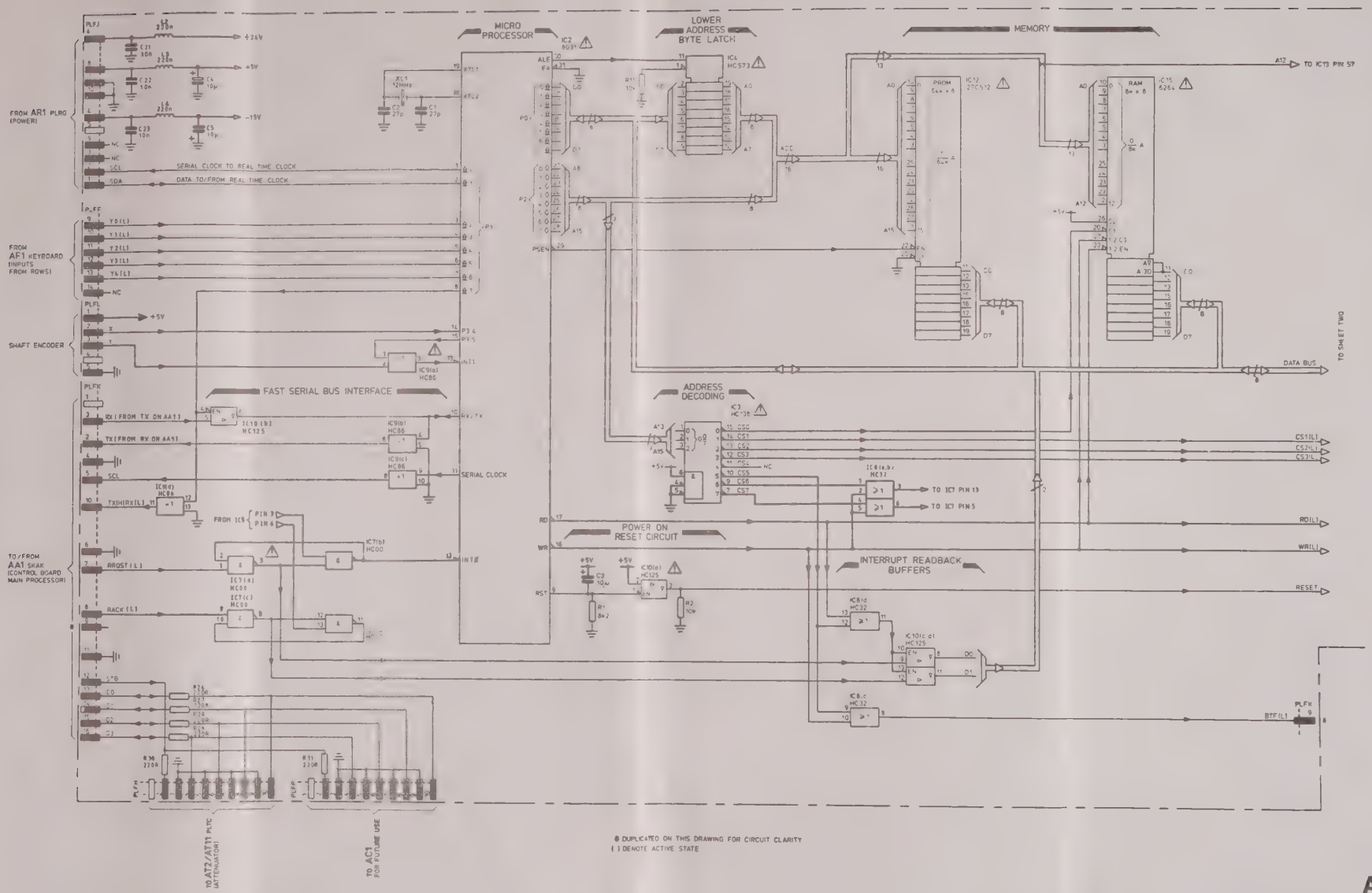


Fig. 7-26 Front panel control component layout


MICRO PROCESSOR
LOWER ADDRESS BYTE LATCH
MEMORY
FAST SERIAL BUS INTERFACE
ADDRESS DECODING
POWER ON RESET CIRCUIT
INTERRUPT READBACK BUFFERS
FROM AR1 PLRG (POWER)
FROM AF1 KEYBOARD (INPUTS FROM ROWS)
SHAFT ENCODER
TO/FROM AA1 SKAK (CONTROL BOARD MAIN PROCESSOR)
SERIAL CLOCK TO REAL TIME CLOCK
DATA TO/FROM REAL TIME CLOCK
DATA BUS
TO SHEET TWO
TO AT2/AT11 PLTC (ATTENUATION)
TO AC1 (FOR FUTURE USE)
DUPLICATED ON THIS DRAWING FOR CIRCUIT CLARITY
( ) DENOTE ACTIVE STATE

AF2/1

Fig. 7-26 Front panel control : Processor and memory circuit diagram

Drg. No. Z 44829/782F Sht. 1 of 2, Iss. 2

(In general, this circuit diagram also applies to earlier versions of the board.)

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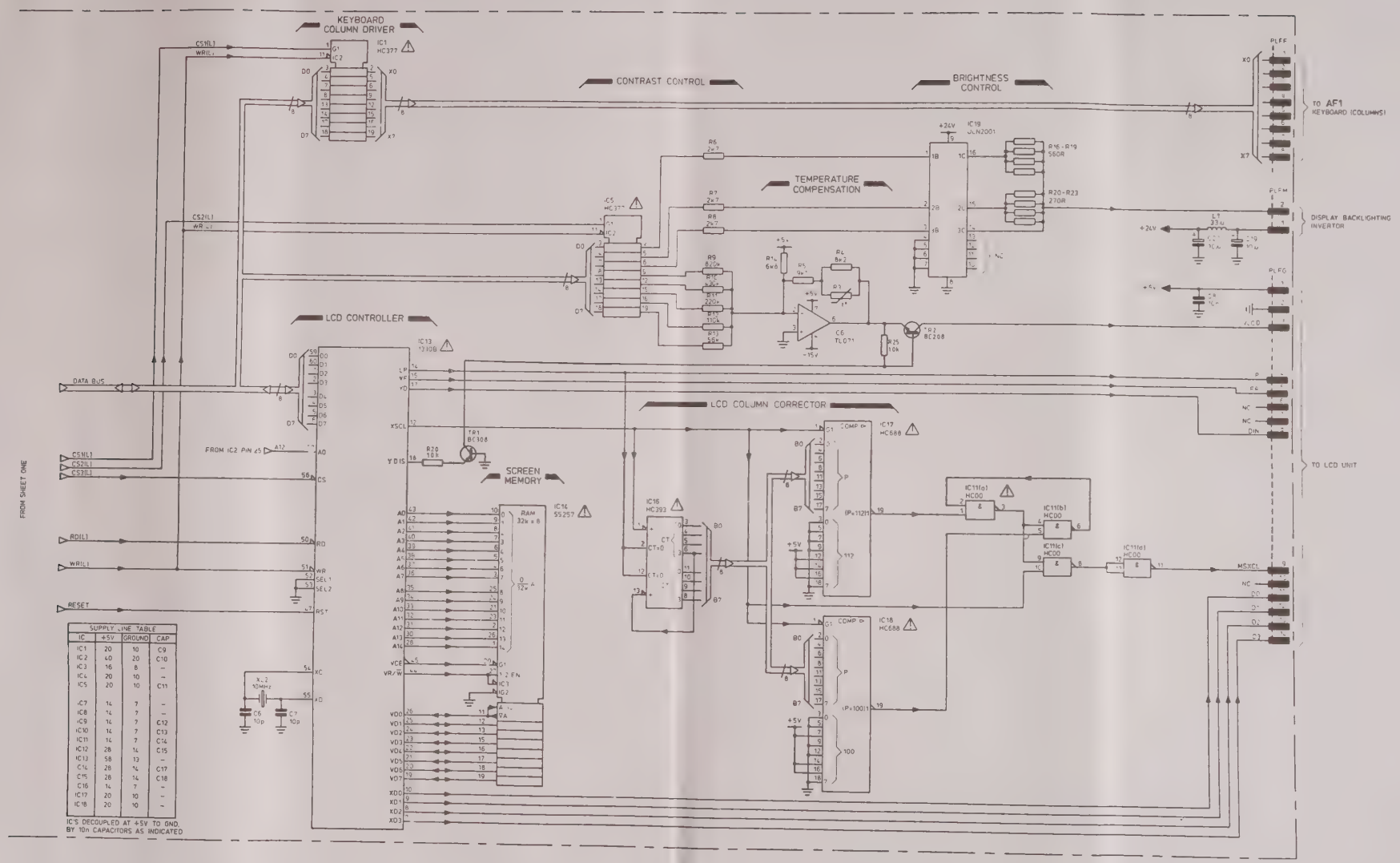

Drg. No. Z 44829/782F Sht. 2 of 2, Iss. 1

(In general, this circuit diagram also applies to earlier versions of the board.)

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AF2/1

Fig. 7-27 Front panel control : LCD controller circuit diagram

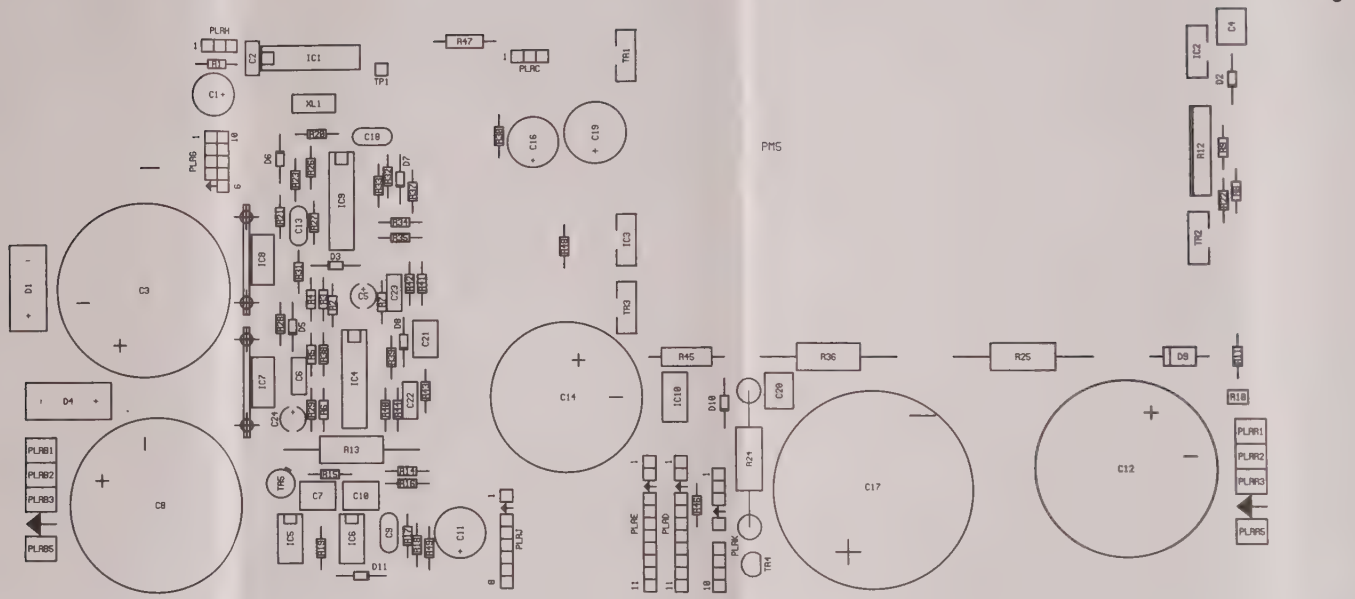
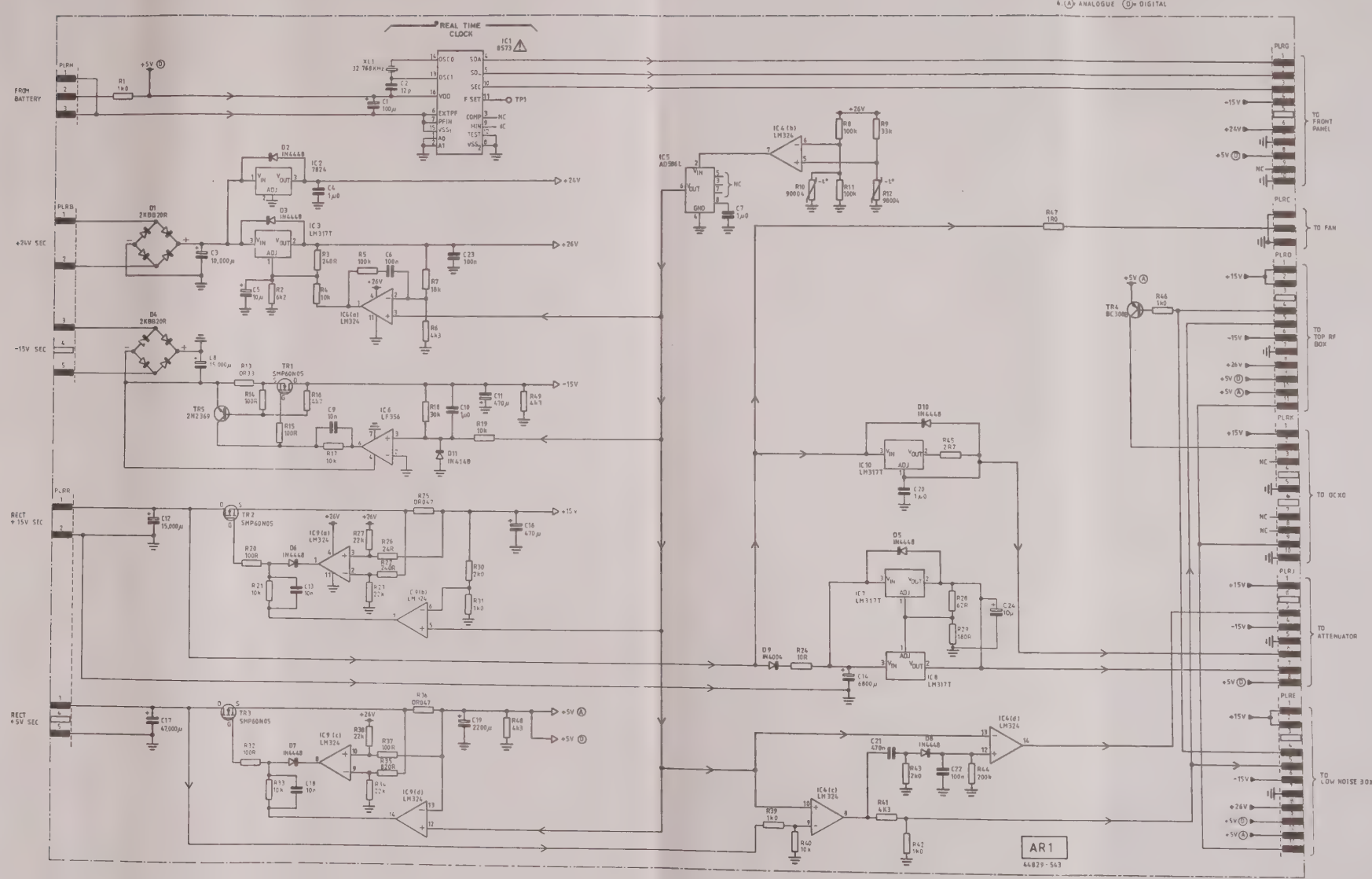


Fig. 7-28 PSU board component layout



Drg. No. Z 44829/543F Sht. 1 of 1, Iss. 4

Fig. 7-28 PSU board circuit diagram

AR1

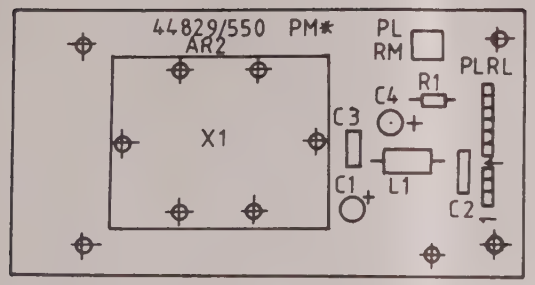
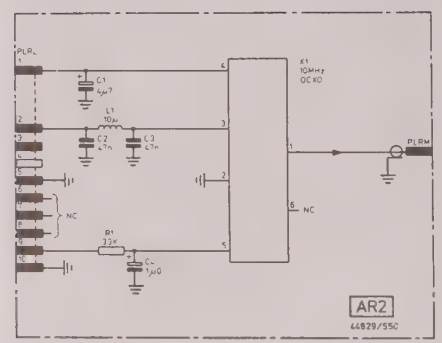


Fig. 7-29 Internal frequency standard component layout



AR2

Fig. 7-29 Internal frequency standard circuit diagram

Drg. No. Z 44829/550W Sht. 1 of 1, Iss. 1

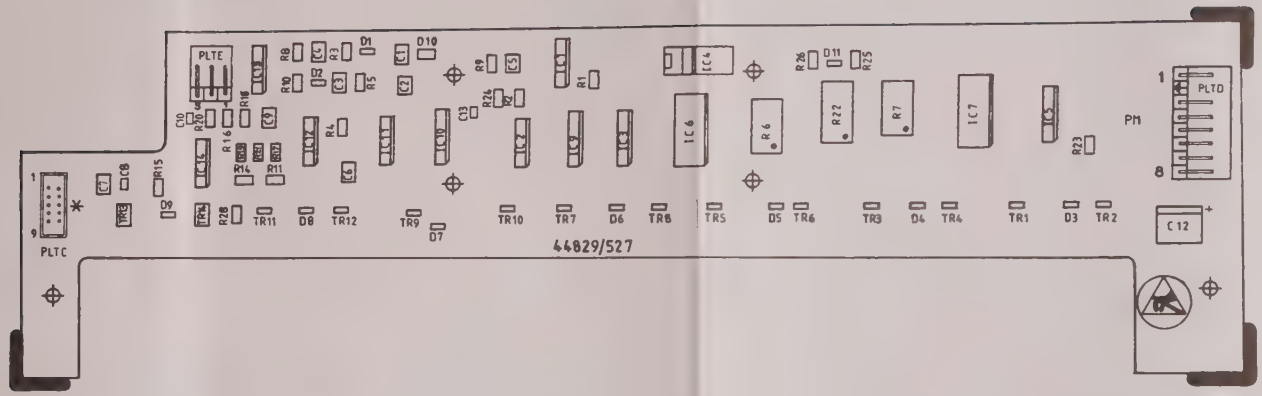
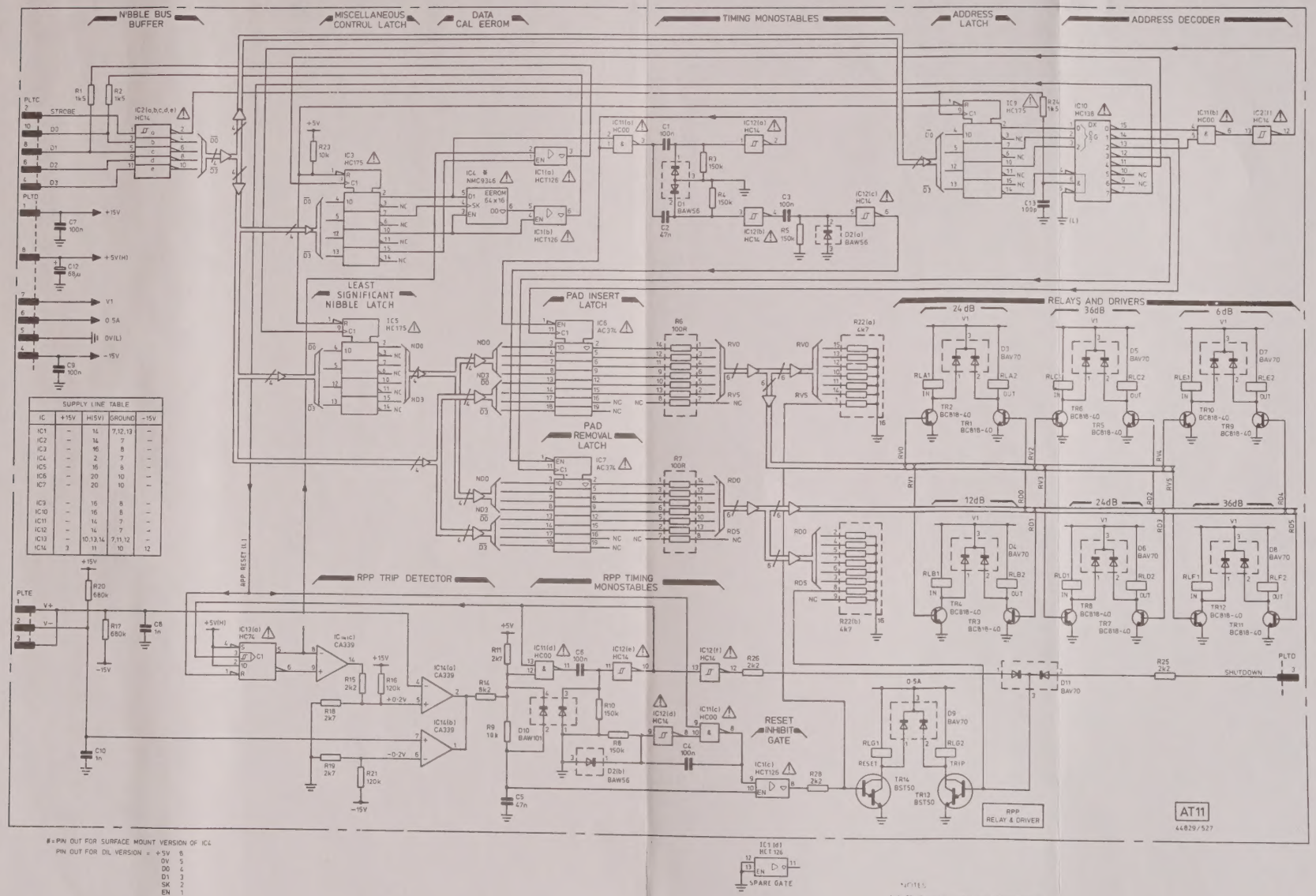


Fig. 7-30 Edgeline controller component layout



Drg. No. Z 44829/527K Sht. 1 of 1, Iss. 5

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AT11

Fig. 7-30 Edgeline controller circuit diagram